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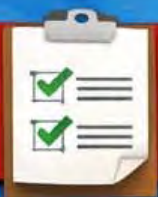


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ICSE Class X Examination Paper 2026

BIOLOGY

SCIENCE PAPER - 3

Time: 2 Hours

Max. Marks: 80

General Instructions:

1. Answer to this Paper must be written on the paper provided separately.
2. You will not be allowed to write during first 15 minutes.
3. This time is to be spent in reading the question paper.
4. The time given at the head of this Paper is the time allowed for writing the answers.
5. Section A is compulsory. Attempt any four questions from Section B.

SECTION-A

(Attempt all questions from this Section.)

QUESTION 1.

Select the correct answers to the questions from the given options. (Do not copy the questions, write the correct answer only).

- (i) Four friends P, Q, R and S were discussing the examples of genetic disorders. The examples they quoted were as follows:

P : Colour blindness and Malaria

Q : Albinism and Cholera

R : Haemophilia and Colour blindness

S : Haemophilia and Albinism

Who gave the correct examples?

- (a) P and Q (b) R and S
(c) P and R (d) Q and S

Ans :

- (b) R and S

Genetic disorders are diseases caused by defects in genes and are inherited from parents. Haemophilia, colour blindness, and albinism are genetic disorders. Malaria and cholera are infectious diseases caused by pathogens and are not inherited. Therefore, only R and S correctly listed genetic disorders.

- (ii) During the ventricular systole, the atrioventricular valves (P) _____ the semilunar valves (Q) _____.

- (a) P – close and Q – open
(b) P – close and Q – close
(c) P – open and Q – close
(d) P – open and Q – open

Ans :

- (a) P – close and Q – open

During ventricular systole, the ventricles contract to pump blood out of the heart. The atrioventricular valves close to prevent blood from flowing back into the atria. At the same time, the semilunar valves open, allowing blood to flow into the aorta and pulmonary artery.

- (iii) **Assertion (A)** : A thick cuticle reduces transpiration by acting as a barrier.

Reason (R) : Desert plants have large, thin leaves for transpiration.

- (a) (A) is true and (R) is false.
(b) (A) is false and (R) is true.
(c) Both (A) and (R) are true and (R) is the correct explanation of (A).
(d) Both (A) and (R) are true but (R) is not the correct explanation of (A).

Ans :

- (a) (A) is true and (R) is false

A thick cuticle is a waxy layer on leaves that reduces water loss by limiting transpiration. This adaptation is common in plants growing in dry environments. However, desert plants usually have small, thick leaves or spines to reduce water loss, not large thin leaves. Therefore, the assertion is true but the reason is false.

- (iv) A sequence of DNA has 300 nitrogenous base pairs, of which 75 are Guanine. What is the number of Thymine in this sequence?

- (a) 150 (b) 100
(c) 50 (d) 75

Ans :

- (d) 75

According to Chargaff's rule, in DNA, Adenine pairs with Thymine and Guanine pairs with Cytosine. If Guanine is 75, Cytosine will also be 75. Therefore, $G + C = 150$. The remaining 150 bases are Adenine and Thymine in equal numbers. Hence, Thymine = 75.

- (v) **Assertion (A)** : Absciscic acid promotes stomatal closure during a drought.

Reason (R) : Absciscic acid helps the plant to conserve water during stress.

- (a) (A) is true and (R) is false.
 (b) (A) is false and (R) is true.
 (c) Both (A) and (R) are true and (R) is the correct explanation of (A).
 (d) Both (A) and (R) are true but (R) is not the correct explanation of (A).

Ans :

(c) Both (A) and (R) are true and (R) is the correct explanation of (A).

Absciscic acid (ABA) is a plant hormone that helps plants respond to stress conditions like drought. It causes stomata to close, reducing water loss through transpiration. By closing stomata, the plant conserves water during stressful conditions. Therefore, both the assertion and reason are true, and the reason correctly explains the assertion.

- (vi) **Assertion (A)** : Leukoderma is the biological term for blood cancer.

Reason (R) : An abnormal increase in the number of WBCs causes blood cancer.

- (a) (A) is true and (R) is false.
 (b) (A) is false and (R) is true.
 (c) Both (A) and (R) are true and (R) is the correct explanation of (A).
 (d) Both (A) and (R) are true but (R) is not the correct explanation of (A).

Ans :

(b) (A) is false and (R) is true

Leukoderma is a skin disorder characterized by loss of skin pigmentation and white patches on the skin. Blood cancer is called leukemia, not leukoderma. Leukemia occurs due to an abnormal increase in the number of white blood cells (WBCs). Therefore, the assertion is false but the reason is true.

- (vii) A health organization wants to educate the rural audience about population control using visually engaging methods. Which of these would be effective?

P : Posters

Q : Loudspeakers

R : Film shows

S : Street plays

(a) P, R and S (b) Q, R and S

(c) P, Q and R (d) P, Q and S

Ans :

(a) P, R and S

Visually engaging methods involve materials or activities that people can see and understand easily. Posters provide visual information, film shows combine audio and visual learning, and street plays demonstrate messages through acting. Loudspeakers mainly provide audio information. Therefore, posters, film shows, and street plays are effective visual methods.

- (viii) A family has a history of colour blindness. During a genetic testing, it was found that the mother is a carrier of colour blindness (X^cX) and the father has normal vision (XY). What is the probability of their sons being colour blind?

- (a) 25% (b) 50%
 (c) 75% (d) 0%

Ans :

(b) 50%

Colour blindness is an X-linked recessive disorder. The mother is a carrier (X^cX) and the father is normal (XY). Sons receive the Y chromosome from the father and one X chromosome from the mother. Half of the sons may inherit the affected X^c chromosome, so the probability of sons being colour blind is 50%.

- (ix) Bharat woke up late in the morning and missed the school bus.



This situation stimulated the nerves of the sympathetic system which resulted in:

- (a) Constriction of Coronary arteries
 (b) Muscle relaxation
 (c) Decrease in Respiration rate
 (d) Bronchodilation

Ans :

(d) Bronchodilation

The sympathetic nervous system prepares the body for fight or flight situations during stress or emergencies. It increases heart rate, respiration rate, and blood flow to muscles. The bronchioles in the lungs dilate to allow more oxygen to enter the body. Therefore, stimulation of the sympathetic system causes bronchodilation.

- (x) Which is the correct sequence of blood flow in the Pulmonary and Systemic Circulation?
- Right Atrium → Right Ventricle → Lungs → Left Atrium → Left Ventricle → Body tissues
 - Left Ventricle → Left Atrium → Body tissues → Right Atrium → Right Ventricle → Lungs
 - Left Ventricle → Left Atrium → Lungs → Right Ventricle → Right Atrium → Body tissues
 - Right Atrium → Right Ventricle → Body tissues → Left Atrium → Left Ventricle → Lungs →

Ans :

- (a) Right Atrium → Right Ventricle → Lungs → Left Atrium → Left Ventricle → Body tissues

In pulmonary circulation, deoxygenated blood flows from the right atrium to the right ventricle and then to the lungs for oxygenation. In systemic circulation, oxygenated blood returns to the left atrium, moves to the left ventricle, and is pumped to the body tissues. This sequence maintains proper blood circulation.

- (xi) Karan was standing on a high stool and cleaning the ceiling fan.



He suddenly loses balance and sustains a head injury. An examination reveals that his pupils have lost the capacity to constrict in bright light. Which structure has been damaged?

- Suspensory ligaments
- Medulla oblongata
- Eye lens
- Eye lid

Ans :

- (b) Medulla oblongata

The medulla oblongata is part of the brainstem that controls several involuntary reflex actions such as breathing, heartbeat, and reflexes like pupil constriction. Damage to this region can disturb these automatic responses. Since the pupil cannot constrict in bright light, it indicates damage to the reflex control centre in the medulla oblongata.

- (xii) A person suffering from kidney failure has proteins in the urine. What is this condition called?

- Hematuria
- Glycosuria
- Albuminuria
- Anaemia

Ans :

- (c) Albuminuria

Albuminuria is the condition in which proteins, especially albumin, are present in the urine. Normally, kidneys filter waste but prevent proteins from passing into urine. When kidney function is damaged or weakened, proteins leak through the glomerulus into the urine. This condition indicates kidney disease or kidney failure.

- (xiii) What does Swachh Bharat Abhiyan aim to achieve in India?

- Increase in deforestation to dump waste
- Expansion of landfill areas to accommodate more waste
- Improved sanitation and solid waste management
- Greater industrial waste production

Ans :

- (c) Improved sanitation and solid waste management

Swachh Bharat Abhiyan is a national cleanliness campaign launched by the Government of India to improve sanitation and hygiene. It aims to eliminate open defecation, promote proper waste disposal, and encourage cleanliness in public places. The program focuses on better sanitation facilities and effective solid waste management across the country.

- (xiv) Varun's mother added plenty of salt to the mango pickle she made. This is to:

- Enhance the colour of the pickle
 - Inhibit the growth of microorganisms
 - Increase the nutritional value
 - Create a hypertonic solution
- A and C
 - B and C
 - C and D
 - B and D

Ans :

- (d) B and D

Salt is added to pickles as a preservative. It creates a hypertonic environment around microorganisms, causing water to move out of their cells by osmosis. This leads to dehydration and prevents their growth. As a result, the pickle remains preserved for a longer time by inhibiting microbial activity.

- (xv) During which phase of the menstrual cycle does the endometrium shed?

- Follicular phase
- Ovulatory phase
- Menstrual phase
- Luteal phase

Ans :

- (c) Menstrual phase

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The menstrual phase is the first stage of the menstrual cycle. During this phase, the thickened endometrium (uterine lining) breaks down and is shed from the body through the vagina. This shedding occurs when fertilization does not take place, and hormone levels such as estrogen and progesterone decrease.

QUESTION 2.

- (i) Give the biological / technical terms for the following:
- The tropic movement wherein the tendrils of a pea plant twine around a support.
 - A defect in our eye in which some parts of the object are in focus while the other parts are blurred.
 - The type of waste generated in hospitals and pathological laboratories.
 - The surgical technique for females that can be used to prevent pregnancy.
 - The evolutionary process by which new species arise from the existing ones.

Ans :

- Thigmotropism
 - Astigmatism
 - Biomedical waste
 - Tubectomy
 - Speciation
- (ii) Given below is the diagram of a human sperm. Read the information below the diagram and fill in the blanks.



Living organisms reproduce to form new individuals of their own kind. This is essential for the survival and continuation of species. Human sperms are microscopic structures that carry genetic material.

The head of the sperm has a cap like organelle called (a) _____ (Lysosome / Acrosome) which produces an enzyme (b) _____ (Hyaluronidase / Amylase) that dissolves the outer layer of the ovum to facilitate fertilization. The nucleus of the sperm has (c) _____ (23 / 46) chromosomes. The middle piece has (d) _____ (Chloroplast / Mitochondria) to provide energy for the motility of the sperm. (e) _____ (Semen / Hymen) is a mixture of sperms and the fluids produced by the male accessory glands.

Ans :

- Acrosome
 - Hyaluronidase
 - 23
 - Mitochondria
 - Semen
- (iii) Choose the odd one out from the following terms and name the category to which the others belong:
- Auxin, Oxytocin, Gibberellin, Cytokinin
 - Growth Hormone, Vasopressin, Thyroid Stimulating Hormone, Gonadotropic Hormone
 - Urochrome, Urea, Uric acid, Nucleic acid
 - Cervix, Chordae Tendineae, Papillary Muscles, Sinoatrial node
 - Morula, Blastocyst, Oviduct, Foetus
- Ans :
1. Odd one : Oxytocin
2. Category : Plant hormones
 1. Odd one : Vasopressin
2. Category : Anterior pituitary hormones
 1. Odd one : Nucleic acid
2. Category : Nitrogenous excretory products
 1. Odd one : Cervix
2. Category : Parts of the human heart
 1. Odd one : Oviduct
2. Category : Stages of embryonic development
- (iv) Mohit, a 30-year-old man was a software professional leading a sedentary life. He showed signs of high blood sugar during a routine health check-up despite having a normal body weight.

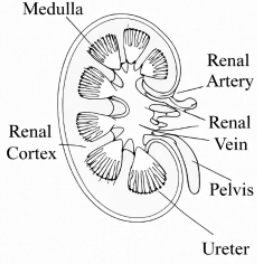


Answer the following:

- The hormonal disorder he is suffering from.
- The hormone responsible for this disorder.
- The organ that secretes this hormone.
- One symptom experienced by Mohit due to this disorder.
- One change in lifestyle to lower the blood sugar level.

Ans :

- (a) Diabetes mellitus
 (b) Insulin
 (c) Pancreas
 (d) Frequent urination
 (e) Regular physical exercise
- (v) Study the diagram given below and match the structure with its functions:
 Example: Pelvis – (f)

Structure		Functions
	(a)	Has Malpighian capsules
	(b)	Carries oxygenated blood
	(c)	Transports urine to urinary bladder
	(d)	Has Henle's loops
	(e)	Carries deoxygenated blood
	(f)	Receives urine which flows into ur

Renal Medulla – (d) Has Henle's loops

Renal Artery – (b) Carries oxygenated blood

Renal Vein – (e) Carries deoxygenated blood

Renal Cortex – (a) Has Malpighian capsules

Ureter – (c) Transports urine to urinary bladder

SECTION-B

QUESTION 3.

- (i) Which is the resting but metabolically active stage of the cell cycle?

Ans :

Interphase

- (ii) Given below is the picture of an eagle.



Eagles have binocular vision. What is the advantage of such a vision?

Ans :

It helps the eagle judge distance accurately and catch its prey easily.

- (iii) Mention the number of Autosomes and Allosomes in a human body cell.

Ans :

- Autosomes: 44
- Allosomes (sex chromosomes): 2

Two well-watered, identical plants were placed in brightly lit rooms at different temperatures – one at 15°C and the other at 38°C. The plant in the warmer room showed wilting by the end of the day.

- (a) Which plant phenomenon resulted in the wilting of the leaves?
 (b) Mention the factor of the phenomenon that is being tested.

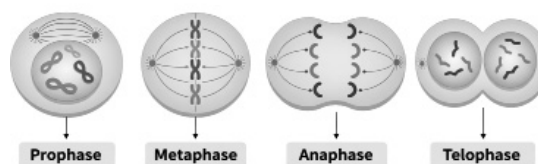
Ans :

- (i) Transpiration
 (ii) Temperature

- (v) Draw a neat labelled diagram of an animal cell showing the Prophase stage of Mitosis with four chromosomes.

Ans :

MITOSIS



QUESTION 4.

- (i) What is the scientific name of modern man?

Ans :

Homo sapiens

- (ii) How are the Cytons and Axons of neurons arranged in the following?

- (a) Cerebrum
 (b) Spinal Cord

Ans :

- (a) Cytons outside (grey matter) and axons inside (white matter).
 (b) Cytons inside (grey matter) and axons outside (white matter).

- (iii) (a) Who proposed the theory of Natural Selection?
 (b) Name the organism which was used as an example to explain Industrial Melanism.

Ans :

- (a) Charles Darwin
 (b) Peppered moth (*Biston betularia*)

- (iv) Differentiate between Plasmolysis and Deplasmolysis.

Ans :

Plasmolysis	Deplasmolysis
Shrinkage of the protoplasm due to loss of water in a hypertonic solution.	Swelling of the protoplasm due to entry of water in a hypotonic solution.
Cell membrane pulls away from the cell wall.	Cell membrane returns to its normal position against the cell wall.

- (v) Akshay's father had a tumour in his prostate gland. His doctor advised him to get it removed surgically. One side effect of the surgery was incontinence of urine, i.e. leakage of urine from the urinary bladder.



- (a) Where is the prostate gland located?
 (b) Why does the prostate gland produce an alkaline secretion?
 (c) Name the structure that regulates the flow of urine from the urinary bladder into the urethra.

Ans :

- (a) Below the urinary bladder, surrounding the upper part of the urethra in males.
 (b) To neutralize the acidic medium of the female reproductive tract and increase sperm motility.
 (c) Sphincter muscle (Urinary sphincter)

QUESTION 5.

- (i) RBCs do not have nuclei. Discuss its advantage.

Ans :

The absence of a nucleus provides more space for haemoglobin, allowing RBCs to carry more oxygen efficiently.

- (ii) Arrange the following food chains in a proper sequence.
 (a) Small fish, Algae, Mosquito larvae, Kingfisher
 (b) Frog, Snail, Crow, Green leaves

Ans :

- (a) Algae → Mosquito larvae → Small fish → Kingfisher
 (b) Green leaves → Snail → Frog → Crow

- (iii) A 28-year-old pregnant lady goes to a gynecologist for a check-up. Her doctor explains that there is normal growth of the foetus and the placenta is functioning well.
 (a) Mention one function of the placenta.
 (b) What connects the placenta to the foetus?

Ans :

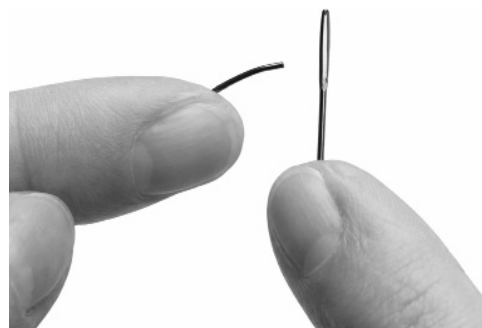
- (a) Exchange of nutrients and oxygen between mother and foetus.
 (b) Umbilical cord

- (iv) Mention any two secondary sexual characteristics in a 15-year-old boy.

Ans :

- Growth of facial hair
- Deepening of voice

- (v) Tara's grandmother is 70 years old and has a passion for embroidery. She faces difficulty in threading the needle as the eye of the needle appears blurred. The ophthalmologist diagnosed it as an age-related disorder.



- (a) Name the eye disorder she is suffering from.
 (b) How can the above defect be corrected?
 (c) Where is the image formed in the above disorder?

Ans :

- (a) Presbyopia
 (b) By using convex lenses (reading glasses).
 (c) Behind the retina.

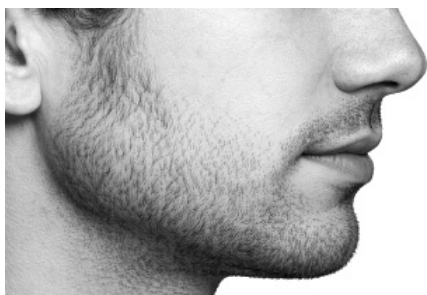
QUESTION 6.

- (i) Explain the term Population Density with reference to human beings.

Ans :

Population density is the number of human beings living per unit area (usually per square kilometre) at a particular time.

- (ii) A 17-year-old girl was having irregular menstrual cycle. Her family physician diagnosed her with Adrenal Virilism. Study the given picture given below and answer the following questions.



- (a) Hypersecretion of which hormone results in Adrenal Virilism in human females?
(b) Mention one symptom of this disorder.

Ans :

- (a) Androgen (Testosterone)
(b) Excess facial hair (beard or moustache growth)
- (iii) Differentiate between Mitosis in plant cell and animal cell based on Cytokinesis.

Ans :

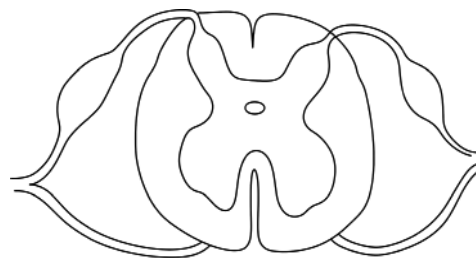
Plant Cell	Animal Cell
Cytokinesis occurs by cell plate formation.	Cytokinesis occurs by cleavage furrow formation.

- (iv) Sara placed a healthy potted plant in a dark room for 48 hours to perform an experiment on photosynthesis.
- (a) Why was the plant placed in the dark for 48 hours?
(b) What is the significance of boiling the leaf in alcohol during the starch test?

Ans :

- (a) To remove previously stored starch from the leaves (destarching).
(b) To remove chlorophyll from the leaf so the iodine test result can be clearly seen.

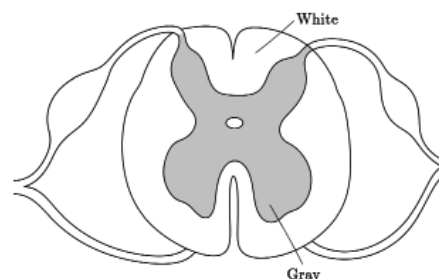
- (v) Copy the diagram given below.



- (a) Name the structure.
(b) Label Gray matter and White matter.

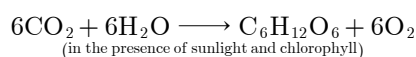
Ans :

- (a) Spinal cord (cross-section)
(b)

**QUESTION 7.**

- (i) Write the overall chemical equation for photosynthesis.

Ans :



Expand the abbreviations:

- (a) NADP
(b) ADP

Ans :

- (i) Nicotinamide Adenine Dinucleotide Phosphate
(ii) Adenosine Diphosphate

- (iii) (a) Explain the term Synapse.
(b) Name the neurotransmitter that allows the transmission of impulses across the synapse.

Ans :

- (a) A synapse is the junction between two neurons where nerve impulses are transmitted from one neuron to another.
(b) Acetylcholine

- (iv) What is the role of the following?

- (a) Leydig cells
(b) Seminiferous tubules

Ans :

- (a) They secrete the male hormone testosterone.
- (b) They produce sperms.

(v) **Vanishing Greenery : A Growing Urban Crisis**

In most of our cities, rapid urbanization has led to a significant decrease in greenery over the past two decades. As the population increased, the demand for housing, roads and commercial buildings grew, leading to clearing of parks, gardens and natural resources. This has contributed to several problems.



- (a) Mention one significant problem caused by the reduction in urban greenery.
- (b) How do green plants contribute to improving the air quality?
- (c) What role can you, as a citizen, play in protecting urban greenery?

Ans :

- (a) Increased air pollution.
- (b) By absorbing carbon dioxide and releasing oxygen during photosynthesis.
- (c) Plant more trees and protect existing green spaces.

QUESTION 8.

- (i) Write the term for the pressure exerted by the cell contents on the cell wall.

Ans :

Turgor pressure

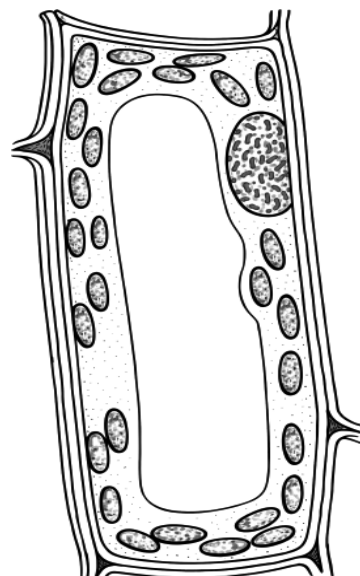
- (ii) (a) Name the fluid present between the meninges in spinal cord.
- (b) What is its function?

Ans :

- (a) Cerebrospinal fluid (CSF)

- (b) It protects the brain and spinal cord by acting as a shock absorber.

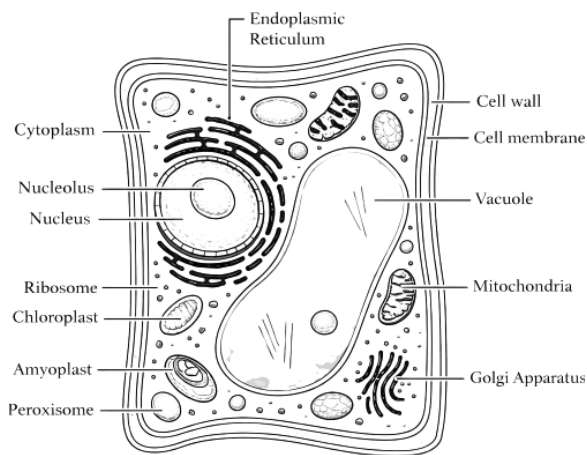
- (iii) Given below is the diagram of a turgid plant cell. Copy the diagram and label Vacuole and Plasma membrane.



Copy the diagram and label Vacuole and Plasma membrane

Ans :

PLANT CELL

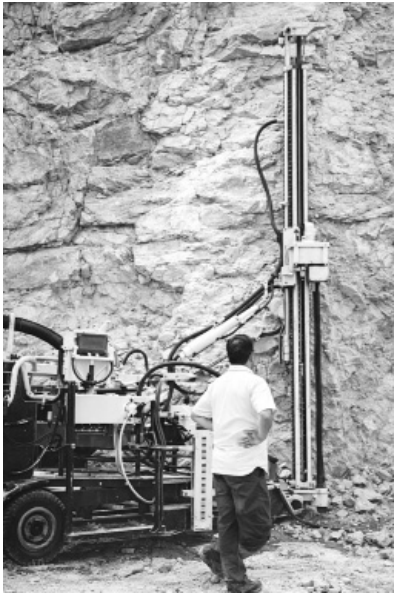


- (iv) Select and write the two biodegradable wastes from the given list:
Styrofoam, Metallic cans, Decaying fruits, Plastic bottles, Newspapers

Ans :

1. Decaying fruits
2. Newspapers

- (v) Rajat Singh was working as a supervisor in a stone quarry where rock, sand and gravel are extracted by digging, drilling and blasting. Over the years he developed hearing loss due to high decibel sound.

**NODIA**

- (a) Give the collective term for the structure located in the internal ear.
- (b) Name the sensory organ in the Cochlea which was damaged for Rajat Singh.
- (c) What kind of pollution do the workers face in the stone quarry?

Ans :

- (a) Labyrinth
- (b) Organ of Corti
- (c) Noise pollution

ICSE CLASS X EXAMINATION PAPER 2025

BIOLOGY

SCIENCE PAPER - 3

Time: 2 Hours

Max. Marks: 80

General Instructions:

1. Answer to this Paper must be written on the paper provided separately.
2. You will not be allowed to write during first 15 minutes.
3. This time is to be spent in reading the question paper.
4. The time given at the head of this Paper is the time allowed for writing the answers.
5. Section A is compulsory. Attempt any four questions from Section B.

SECTION-A

(Attempt all questions from this Section.)

QUESTION 1.

Select the correct answers to the questions from the given options.

(Do not copy the questions, write the correct answer only).

- (i) The number of live births per thousand people per year is called:
- (a) Mortality
 - (b) Population density
 - (c) Population growth rate
 - (d) Natality

Sol :

(d) Natality

Natality is defined as the number of live births per thousand individuals in a population annually. It measures birth frequency and is distinct from mortality, population density or population growth rate, focusing solely on new births occurring in a year.

- (ii) The structure that lies at the junction of the choroid and the iris and is itself a part of the choroid is called:
- (a) Ciliary body
 - (b) Suspensory ligament
 - (c) Pupil
 - (d) Lens

Sol :

(a) Ciliary body

The ciliary body is at the junction of the choroid and iris. It is part of the choroid and plays a key role in controlling lens shape and producing aqueous humor essential for eye function, vital for proper vision indeed.

- (iii) **Assertion (A)** : Seminal vesicles pour an alkaline secretion into the semen as it passes through the ureter.

Reason (R) : The female vagina is acidic and needs to be neutralized for sperm survival.

- (a) (A) is true and (R) is false.
- (b) (A) is false and (R) is true.
- (c) Both (A) and (R) are true.
- (d) Both (A) and (R) are false.

Sol :

(b) (A) is false and (R) is true.

The assertion is false because seminal vesicles do not discharge secretion via the ureter; they add alkaline fluid to semen through the vas deferens. The reason is true, as vaginal acidity is neutralized by alkaline secretions to support sperm survival.

- (iv) The hormone that induces vigorous contractions of the uterus in a pregnant mother is:

- (a) Oestrogen
- (b) Prolactin
- (c) Oxytocin
- (d) Progesterone

Sol :

(c) Oxytocin

Oxytocin is the hormone primarily responsible for inducing strong uterine contractions during labor in pregnant mothers. It plays a critical role in facilitating childbirth by powerfully stimulating the muscles of the uterus, helping to expel the baby during delivery efficiently.

- (v) A scientist wanted to conduct a genetic experiment on mice. He cut the tails of all the mice and made them reproduce. What will be the phenotype of the offsprings?

- (a) All the offsprings will be tailless.
- (b) There will be a mix of tailed and tailless offsprings.
- (c) All the offsprings will have tails.
- (d) Tail of the offsprings cannot be predicted.

Sol :

(c) All the offsprings will have tails

Cutting the tails of mice does not alter their genetic code, as the trait for a tail is encoded in their DNA. Therefore, offspring inherit the normal tail trait, and all will have tails because genetic traits always remain unchanged.

(vi) **Assertion (A) :** A turgid plant cell is in a balanced state.

Reason (R) : In a turgid cell, turgor pressure and wall pressure are equal and in the same direction.

(a) (A) is true and (R) is false.

(b) (A) is false and (R) is true.

(c) Both (A) and (R) are true.

(d) Both (A) and (R) are false.

Sol :

(a) (A) is true and (R) is false.

A turgid plant cell is in equilibrium because internal turgor pressure balances cell wall resistance. However, the wall does not produce a directional force equal to turgor pressure. Thus, the assertion is correct, but the reason is stated incorrectly.

(vii) The optimum temperature for photosynthesis is:

(a) 10 – 15°C

(b) 60 – 65°C

(c) 40 – 45°C

(d) 25 – 35°C

Sol :

(d) 25 – 35°C

Photosynthesis is most efficient between 25–35°C because enzymes in the process work optimally within this range. Beyond these temperatures, enzyme activity declines significantly, reducing photosynthetic rates, which confirms 25–35°C as the optimum temperature range.

(viii) Ajay and Vijay are siblings. Ajay can roll his tongue while Vijay cannot. What is the genotype of their parents?

(a) Both the parents are homozygous dominant.

(b) Both the parents are homozygous recessive.

(c) One parent is homozygous dominant, and the other is homozygous recessive.

(d) Both the parents are heterozygous dominant.

Sol :

(d) Both the parents are heterozygous dominant.

Tongue rolling is controlled by a dominant allele. Since one sibling can roll and the other cannot, both parents must be heterozygous carriers, providing both dominant and recessive alleles to their offspring, which explains the observed variation in tongue rolling.

(ix) **Assertion (A) :** Deficiency of Antidiuretic hormone causes an increase in urination.

Reason (R) : Antidiuretic hormone acts on the kidney to reabsorb water from the kidney tubules.

(a) (A) is true and (R) is false.

(b) (A) is false and (R) is true.

(c) Both (A) and (R) are true.

(d) Both (A) and (R) are false.

Sol :

(c) Both (A) and (R) are true

A deficiency of antidiuretic hormone reduces water reabsorption in kidney tubules, leading to increased urination. Since ADH normally acts on kidney tubules to reabsorb water, both the assertion and reason are true, confirming the correctness of answer (c).

(x) A phase of cell division where the spindle fibres disappear is:

(a) Telophase

(b) Prophase

(c) Metaphase

(d) Anaphase

Sol :

(a) Telophase

Telophase is the phase where spindle fibers disintegrate after chromosomes reach opposite poles, and the nuclear envelope reassembles, marking the final stage of mitosis prior to cytokinesis. Thus, answer (a) is correct, as expected in mitosis.

(xi) **Assertion (A) :** Arachnoid layer helps in speeding up the transmission of nerve impulses along the axons.

Reason (R) : Axon endings at the synapse secrete acetylene.

(a) (A) is true and (R) is false.

(b) (A) is false and (R) is true.

(c) Both (A) and (R) are true.

(d) Both (A) and (R) are false.

Sol :

(d) Both (A) and (R) are false

The arachnoid layer does not accelerate nerve impulse transmission, and axon endings secrete neurotransmitters like acetylcholine—not acetylene. Consequently, both the assertion and reason are false, which makes the answer completely indisputable.

(xii) Many nuclear power plants are constructed near water sources. They use water for cooling their machinery and release it back into the water stream. Identify the kind of pollution caused.

(a) Radiation pollution

(b) Water pollution

(c) Industrial pollution

(d) Thermal pollution

Sol :

(d) Thermal pollution

Cooling water in nuclear power plants absorbs heat and is discharged at elevated temperatures into natural water bodies. This thermal discharge disrupts aquatic ecosystems, causing thermal pollution. Therefore, the correct classification of this phenomenon is thermal pollution.

- (xiii) Owls are nocturnal animals. They are active at night and hunt small animals for food. Owls have large eyes and can see well at night. This is due to:



- (a) Cones and Rhodopsin
- (b) Rods and Iodopsin
- (c) Rods and Rhodopsin
- (d) Cones and Iodopsin

Sol :

- (c) Rods and Rhodopsin

Owls possess a higher number of rod cells containing the photopigment rhodopsin, which is highly sensitive to low light levels. This specialized adaptation enables them to detect movement and see clearly at night, facilitating hunting of prey in dark conditions.

- (xiv) Sunil tried to match the tropic movements in plants with the stimulus they respond to. The tabulation is given below:

	Tropism	Stimulus
P	Thigmotropism	Touch
Q	Geotropism	Water
R	Chemotropism	Chemicals
S	Phototropism	Gravity

Identify the correct pair:

- (a) P and R
- (b) Q and S
- (c) R and S
- (d) P and R

Sol :

- (a) P and R

In the provided tabulation, thigmotropism correctly corresponds to touch, and chemotropism to chemicals. However, geotropism and phototropism are incorrectly paired with water and gravity respectively. Therefore, the only accurate relationships are thigmotropism with touch and chemotropism with chemicals indeed overall.

- (xv) Observe the following picture, identify the defect and the cause of the defect.



(a) Simple goitre, under secretion of thyroxine.



(b) Exophthalmic goitre, over secretion of thyroxine.

- (a) Simple goitre, under secretion of thyroxine.
- (b) Ex-ophthalmic goitre, over secretion of thyroxine.
- (c) Simple goitre, over secretion of thyroxine.
- (d) Ex-ophthalmic goitre, under secretion of thyroxine.

Sol :

- (b) Ex-ophthalmic goitre, over secretion of thyroxine

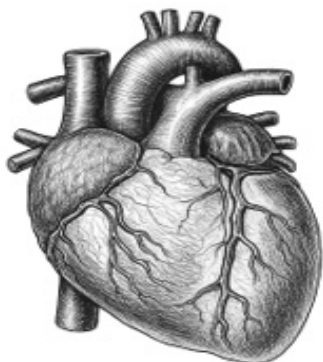
Ex-ophthalmic goitre is characterized by thyroid hyperactivity, which results in excessive thyroxine production. This over secretion stimulates eye tissues causing protrusion. Thus, the defect observed in the image corresponds to an overactive thyroid leading to ex-ophthalmic goitre as expected clinically.

QUESTION 2.

- (i) Name the following:

- (a) The fully developed part of the ovary containing a mature ovum.
- (b) A waxy layer on the upper epidermis of leaves meant to reduce Transpiration.
- (c) The ear ossicle which opens into the oval window of Cochlea.
- (d) The physiological process which is the starting point of all food chains.
- (e) An insect which is a classic example of natural selection due to industrial melanism.

- (ii) Given below is the diagram of a human heart. Read the information below the diagram and fill in the blanks:



The human heart pumps blood throughout the body. It is the size of a large fist. The heart is located between the lungs in the thoracic cavity. It has four chambers. The heart functions all through the lifespan of a person and is responsible for the survival of the person.

The heart is enclosed by a membrane called (a) _____. The ventricles give rise to two large blood vessels called (b) _____ and (c) _____. The flaps of the cuspid valves are kept in position by (d) _____. (e) _____ arteries supply oxygenated blood to the walls of the heart.

- (iii) Arrange the terms in each group in the correct order. Write them in a logical sequence beginning with the term that is underlined.

- Palisade cells, Cuticle, Upper epidermis, Spongy cells.
- Hepatic portal vein, Stomach, Hepatic vein, Liver.
- Cyton, Dendrites, Synaptic cleft, Axon endings.
- Insulin release, High blood sugar, Lowers blood sugar, Stimulates glucose uptake from blood.
- Sperm duct, Seminiferous tubule, Epididymis, Efferent ducts.

- (iv) Read the explanations given below and name the structures:
Example: The tubules which produce sperms.

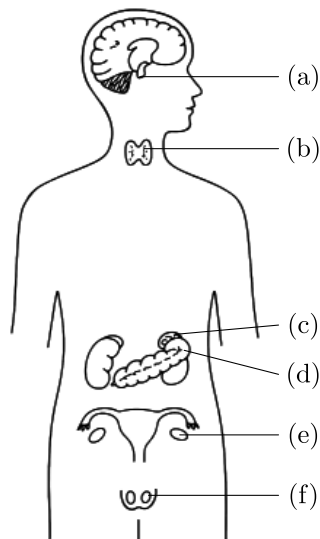
Answer : Seminiferous tubules

- The canal through which the testes descend down into the scrotum just before the birth of a male baby.
- The part of the brain that regulates the peristaltic movement of the alimentary canal.
- A structure that collects the soundwaves and conducts them through the external auditory canal.
- The point of attachment of two chromatids of a chromosome.
- Regulation of the opening and closing of stomata.

- (v) Given below is an outline of the human body showing the important endocrine glands.

Match the glands marked (a) to (e) with their correct functions:

Example: (f) - 6. Secretes Testosterone.



Endocrine glands

	Functions
1.	Prepares the body to face stress.
2.	Secretes tropic hormones
3.	Secretes Oestrogens
4.	Maintains blood sugar level
5.	Regulates basal metabolism
6.	Secretes Testosterone.

Sol :

- Graafian follicle.
 - Cuticle
 - Stapes
 - Photosynthesis
 - Moth
- Pericardium
 - Pulmonary artery
 - Aorta
 - Chordae tendineae
 - Coronary arteries
- Cuticle, Upper epidermis, Palisade cells, Spongy cells.
 - Stomach, Hepatic portal vein, Liver, Hepatic vein.
 - Dendrites, Cyton, Axon endings, Synaptic cleft.
 - High blood sugar, Insulin release, Stimulates glucose uptake from blood, Lowers blood sugar.
 - Seminiferous tubule, Efferent ducts, Epididymis, Sperm duct.

- (iv) (a) Inguinal canal
(b) Medulla oblongata
(c) Ear pinna
(d) Centromere
(e) Guard cells

(v)

Endocrine glands		Functions
(a)	2.	Secretes tropic hormones
(b)	5.	Regulates basal metabolism
(c)	1.	Prepares the body to face stress
(d)	4.	Maintains blood sugar level
(e)	3.	Secretes oestrogens

QUESTION 3.

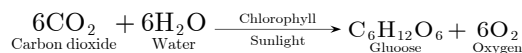
- (i) Write the overall chemical equation for photosynthesis.
- (ii) Ramesh is a farmer who has a vineyard and cultivates grapes. To improve the shape of the grapes and make them elongated he sprays a particular phytohormone at the time of fruiting.



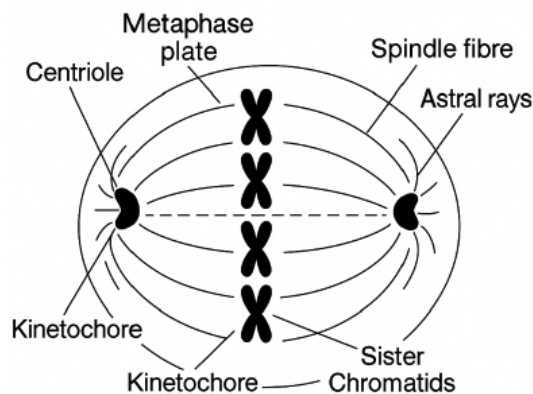
- (a) Name the phytohormone that Ramesh sprays on the plant at the time of fruiting.
- (b) These grapes are said to be seedless. What is the technical term for the formation of such fruits?
- (iii) Mention the two pairs of nitrogenous bases that are present in a DNA strand and pair with each other by hydrogen bonds.
- (iv) State any two disadvantages of living close to an airport.
- (v) Draw a neat, labelled diagram of an animal cell Showing Metaphase with four chromosomes

Sol :

- (i) Chemical equation for photosynthesis are as follows :

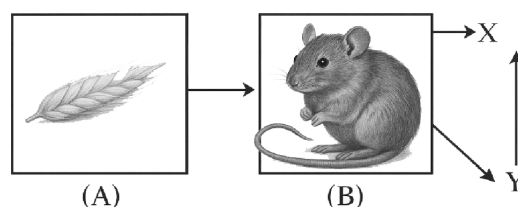


- (ii) (a) Gibberellin
(b) Parthenocarp
- (iii) Adenine (A) always pairs with thymine (T) through two hydrogen bonds, while guanine (G) always pairs with cytosine (C) through three hydrogen bonds.
- (iv) Disadvantages of living close to an airport are
(a) It interferes in communication.
(b) It interrupts concentration of thought and disturbs peace of mind.
(c) It lowers efficiency of work.
(d) It disturbs sleep and leads to nervous irritability.
(e) A sudden loud sound can damage eardrum and prolonged noise can even lead to deafness.
(f) Life of animals like birds gets disturbed by aircrafts landing or taking off from the airports.
- (v)

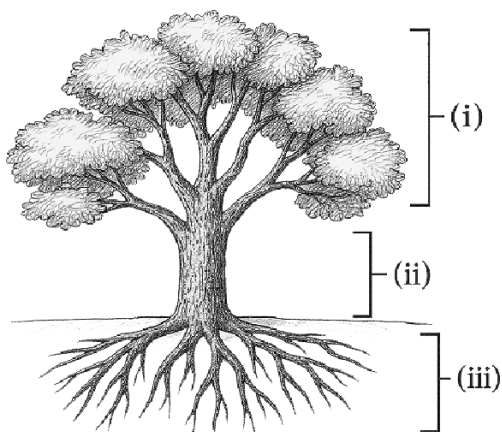


QUESTION 4.

- (i) What is the structure of DNA as proposed by Watson and Crick?
- (ii) Name the white blood cells that:
(a) show phagocytosis
(b) produce antibodies
- (iii) Complete the food chain by mentioning the names of the organisms in (c) and (d)

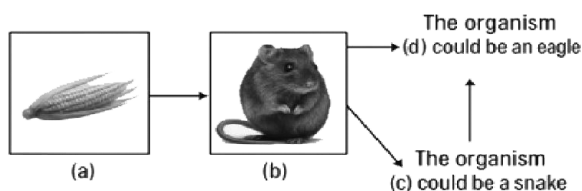


- (iv) State any two harmful effects of acid rain.
- (v) Given below is a picture of a tree. Mention the scientific phenomena occurring in the parts labelled (a), (b) and (c).



Sol :

- (i) J.D. Watson and F.H.C. Crick proposed a double helical model of DNA. DNA molecule consists of two polynucleotide strands coiled around a common axis, forming a double helix. Each helical turn has a length of 3.4 nm in which ten nucleotides are present.
- (ii) (a) Neutrophils or monocytes.
(b) Lymphocytes



- (iv) 1. Acid rain causes damage to crops, buildings and many other things.
2. Acid rain water accumulates in river causing death of aquatic life.
- (v) The scientific phenomena occurring in the part labelled (a) is absorption.
The scientific phenomena occurring in the part labelled (b) is transpirational pull.
The scientific phenomena occurring in the part labelled (c) is transpiration.

QUESTION 5.

- (i) What is Micturition? Explain.
- (ii) What are biomedical wastes? Give an example.

- (iii) Differentiate between the functions of Urethra and Uterus.
- (iv) Rachna is an expert gymnast on the balance beam. She has been vigorously practising for the Olympic Games. Lately, she has been experiencing dizziness and losing her balance during the practise sessions.



- (a) Which part of the membranous labyrinth is responsible for maintaining the body balance on the beam?
- (b) Which type of balance is maintained by the structure mentioned in (a)?
- (v) Draw a neat, labelled diagram to show that oxygen is released during photosynthesis.

Sol :

- (i) The process of expelling urine from the urinary bladder through the urethra is called micturition.
- (ii) The wastes generated by hospitals, clinics, laboratories, nursing homes, etc. are referred to as biomedical wastes.

Examples: Needles, syringes, dirty dressing, gloves, surgery wastes, etc. (Any one)

- (iii) Differences between urethra and uterus are as follows:

Urethra	Uterus
It is a part of male and female excretory systems.	It is a part of female reproductive system.
It is a tube that carries urine from urinary bladder to outside of the body.	It is a hollow muscular organ where a fertilised egg implants and a fetus develops.

- (iv) (a) The vestibular apparatus is concerned with the maintenance of body balance.
(b) Both static as well as the dynamic balances are maintained by the vestibular apparatus.

(v)

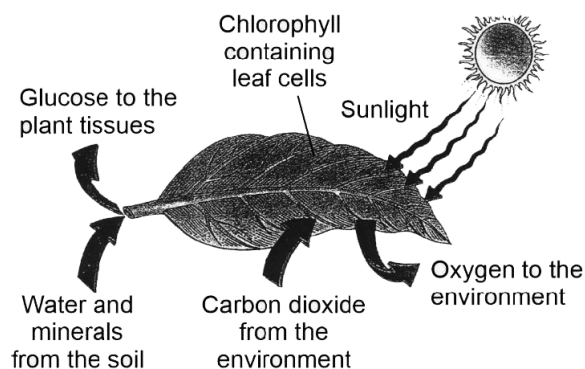


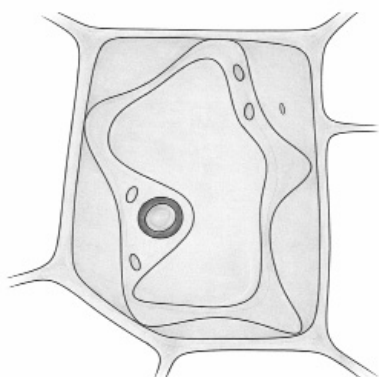
Fig.: Photosynthesis in a green leaf

QUESTION 6.

- (i) Where are Hydathodes located?
- (ii) What are Vestigial organs? Give one example of a vestigial structure in the human mouth.
- (iii) Ahmed had a severe throat infection. After a few days he developed an earache too. What could be the reason for the pain in his ears? Explain
- (iv) Mr. Sharma is a 76 year old man. His vision was gradually becoming blurred. He consulted an eye doctor and it was diagnosed as cataract.



- (a) Which part of the eye does cataract affect?
 - (b) Why does the vision become blurred?
- (v) Given below is the diagram of a plasmolysed cortical cell of a root.

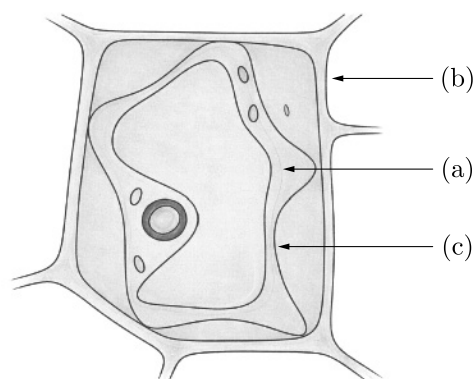


Copy the diagram and label the following parts in the diagram:

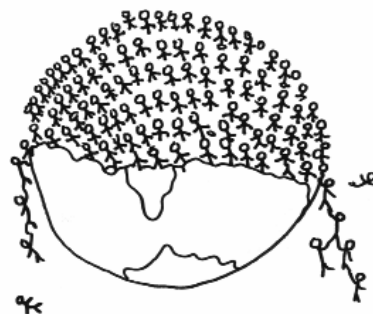
- (a) Cytoplasm
- (b) Hypertonic solution
- (c) Plasma membrane

Sol :

- (i) Hydathodes are present at the tips of veins in leaves.
- (ii) Vestigial organs – Those organs which are non-functional in the possessor but were functional in the ancestors are known as vestigial organs.
Wisdom tooth is an example of vestigial organ in human body.
- (iii) Ahmed is suffering from tonsillitis.
The ear pain occurs due to irritation in nerves that are connected to both throat and ears.
- (iv) (a) Eye lens.
(b) It occurs because the eye lens turns opaque.
- (v)



- (vi) Define the term Allele.
- (vii) In the last century, the human population has increased tremendously. Death rate has reduced and life expectancy has increased. This rapid growth has placed significant pressure on resources. Global cooperation is needed for environmental preservation.



- (a) Mention any one reason for reduction in the death rate.
- (b) Name any one resource that is under pressure due to population explosion.

- (viii) Mention any two functions of amniotic fluid.
- (ix) Expand the following abbreviations:
 (a) CFC
 (b) CNG
- (x) Vineet's day begins with a cup of piping hot coffee. Caffeine is a stimulant present in coffee which increases the circulation of Adrenaline in the body. Vineet feels refreshed, alert and focussed.



- (a) Name the organ that is stimulated by caffeine which makes Vineet alert and focussed.
- (b) Give the collective term for the protective membranes of the organ mentioned in (a).
- (c) Which part of the autonomic nervous system increases the secretion of Adrenaline?

Sol :

- (i) Allele represents the two alternative forms of a unit factor (or a gene).
- (ii) (a) The main factors that contribute to the decline in death rate in a population are as:
1. Protection from natural risks: Living in houses protected man from wild animals, heat, cold, rain, etc.
 2. Advancement in agriculture: Improved agricultural techniques increased food output for the rising population.
 3. Storage facility: Better storage facility made food available all the year round. It has also minimized the loss of grain by pests.
 4. Control of diseases: Control of communicable diseases with antibiotics, elimination of epidemics and sound public health measures reduced the death rate.
- (b) A population explosion puts immense pressure on resources like water, land, food, energy, etc.
- (iii) Functions of amniotic fluid are:

- (a) It prevents desiccation of the embryo.
- (b) It supports fetal movement.
- (c) It maintains stable temperature.
- (iv) (a) CFC – Chlorofluorocarbon
 (b) CNG – Compressed natural gas
- (v) (a) Brain
 (b) Meninges
 (c) Sympathetic nervous system

QUESTION 7.

- (i) Explain the term Excretion.
- (ii) State the difference between Nephron and Neuron.
- (iii) Mention any two objectives of Swachh Bharat Abhiyan.
- (iv) Give any two characteristic features of a Cro-Magnon man. A farmer cultivates a unique species of tomato plants. The two traits selected for breeding were: Colour of the fruits and height of the plants. The farmer initially crosses a homozygous tall plant bearing red fruit (T⁺T⁺R⁺R⁺) with a dwarf plant bearing yellow fruit (t⁻t⁻r⁻r⁻) and the genotype of all the offspring of the F¹ generation was TtRr. Next, he crosses two F¹ generation plants (TtRr).



Tall plant with red fruits



Dwarf plant with yellow fruits

- (a) Explain the phenotype of the offsprings of the F² generation obtained from the initial cross.
- (b) Mention the phenotypic ratio of the F² generation offsprings.
- (c) State Mendel's Law of Independent Assortment.

Sol :

- (i) The process by which harmful metabolic waste products are eliminated from the body is called excretion.
- (ii) Differences between nephron and neuron are:

Nephron	Neuron
It is the structural and functional unit of the kidneys.	It is the structural and functional unit of neural system.

It is responsible for filtration of blood and urine production.	It is responsible for transmitting electrical signals (impulses) within the body.
---	---

(iii) Objectives of Swachh Bharat Abhiyan are:

- Eliminating open defecation through the construction of household-owned and community-owned toilets.
- Establishing an accountable mechanism of monitoring toilet use.

(iv) Characteristics of a Cro-Magnon man are:

The Cro-Magnon man had, like us, about 1.8 metres tall, well-built body.

- His face was perfectly orthogonally with an arrow, elevated nose, broad and arched forehead, moderate brow-ridges, strong jaws with man-like dentition, and a well-developed chin.
- His cranial capacity was, however, somewhat more than ours, being about 1650 c.c. It is, therefore, believed that Cro-Magnon man was somewhat more intelligent and cultured than the man of today.
- It could walk and run faster and lived with families in caves.
- It made excellent tools and even ornaments, not only of stones and bones, but also of elephant tusks.
- Its tools included spears, bows and arrows, as he was omnivorous.
- Use of the skin clothes by this man is also confirmed.

Phenotype: Tall plant, red fruits Dwarf plant, yellow fruits

Genotype: $\boxed{TTRR}$ $\boxed{ttrr}$

Gametes: $\textcircled{TR}$ $\textcircled{tr}$

$\boxed{TtRr}$

F₁ generation: (All tall red fruits)
On selfing F₁ generation

Gametes: →	TR	Tr	tR	tr
TR	TTRR	TTRr	TtRR	TtRr
Tr	TTRr	TTrr	TtRr	Ttrr
tR	TtRR	TtRr	ttRR	ttRr
tr	TtRr	Ttrr	ttRr	ttrr

- All the plants obtained in the F₂ generation will be tall with red fruits (TtRr).

- Phenotypic ratio of the F₂ generation offsprings is 9:3:3:1.

- Law of Independent Assortment:

This law states that the alleles of two different characters/traits segregate or assort independently i.e., the segregation of alleles of a trait in the gametes is independent of the segregation of alleles of the other trait.

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CHAPTER 1

CELL CYCLE AND STRUCTURE OF CHROMOSOMES

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1. CELL DIVISION

Cell Division is a method by which new cells are originated from pre-existing cells. These new cells need to be produced for growth, development, replacement, repair and reproduction. All organisms contain an even number ($2n$) of chromosomes in their somatic or body cells. The cell division leading to growth, development, repair and replacement is called Mitosis. The cell division leading to production of gametes (sex cells) is called meiosis.

2. CELL CYCLE

The sequence of events including growth and division, that a cell undergoes from the time of its formation upto its division into daughter cells is called cell cycle. Every cell capable of division passes through cell cycle which consists of two phases :

1. Interphase [Resting or non-dividing phase; I phase]
2. Mitotic phase or Mitosis [Dividing phase; M phase]

3. INTERPHASE (RESTING PHASE)

It is the non-dividing preparatory phase during which a cell grows to its maximum size (by increase in volume of nucleus and nucleolus) and the synthesis of DNA (chromosome material) takes place. Due to the duplication of DNA contents the chromatin material also duplicates . Interphase is divided into three sub-stages.

- (a) G_1 – phase : Volume of cytoplasm increases and protein synthesis takes place.
- (b) S – phase : Synthesis of DNA takes place.
- (c) G_2 – phase : Necessary spindle proteins are synthesized.

The cell is quite active metabolically during this phase and several processes, including DNA synthesis, occur at this time, thus no alternative is left for the cell except to divide by the process of mitosis.

MITOTIC PHASE OR MITOSIS (DIVIDING PHASE)

It is the dividing phase during which nucleus as well as cytoplasm divide into two daughter cells. It is studied in two parts :

- (i) Karyokinesis (ii) Cytokinesis
- (i) **Karyokinesis (Division of nucleus)** : In this many events take place in a sequence which are studied in four stages.

1. **Prophase** : It begins with the appearance of chromosomes which have become short, thick and clearly visible inside the nucleus. Each chromosomes get duplicated by splitting longitudinally to form two chromatids which are attached to each other at a small region called centromere. The centrosome (in animal cell) splits into two along with duplication of centrioles which move towards opposite poles of the cell. Each centriole is surrounded by asters (centrioles along with astral rays). A number of spindle fibres appear between two daughter centrioles.

In plant cell due to the absence of centrosome (centriole), the formation of spindle fibres take place from cytoplasmic strands (microtubules) of the cell.

The nuclear membrane and nucleolus disappear. The chromosomes start moving towards equator of the cell.

2. **Metaphase** : The chromosomes get arranged at the equatorial plate of the cell. Each chromosomes get attached itself to a spindle fibre by its centromere.
3. **Anaphase** : Centromere divides and two sister chromatids of each chromosome separate and are drawn apart towards opposite poles to form two groups of chromosomes.
4. **Telophase** : Each Chromatid or daughter chromosome turns into a network of chromatin threads. Nuclear membrane and nucleolus reappear.

- (ii) **Cytokinesis (Division of cytoplasm)** : A constriction (furrow) appears in the cell

membrane at the middle of the animal cell, which deepens and finally splits the cytoplasm into two, thus producing two new cells. In plant cell instead of a furrow, a cell plate is laid down in the cytoplasm at the equatorial plate. It grows from centre to periphery, thus dividing the original cell into two daughter cells.

Note : In Mitosis, two identical daughter cells are produced by division of one parent cell. The main aspect of this division is that the same normal chromosome number is maintained at each division of the cell. Hence, it is also called as Equational cell division.

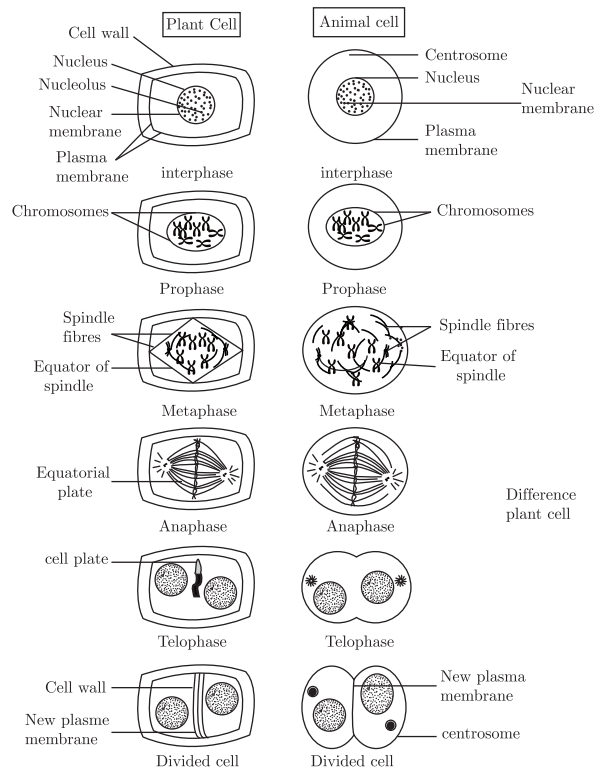
Identification points of Mitosis :

1. Prophase – Chromosomes with two chromatids, disappearance of nuclear membrane as well as nucleolus and formation of the spindle.
2. Metaphase – Chromosomes arranged at equatorial plate.
3. Anaphase – Movement of daughter chromosomes towards pole.
4. Telophase – Uncoiling of chromosomes, disappearance of spindle, reappearance of nucleolus and nuclear membrane.

Differences between mitosis in animal and plant cell are as follows :

	Animal cell		Plant cell
1.	Spindle formed is amphiastral.	1.	Spindle formed is anastral.
2.	Cytokinesis by constriction (furrow) method.	2.	Cytokinesis by formation of cell plate.
3.	Cytokinesis proceeds from outside to centre.	3.	Cytokinesis proceeds from centre towards periphery.
4.	Centrosome present so 2 asters are formed.	4.	Centrosome absent so no asters are formed.

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4.1 Significance of Mitosis

The Significance of Mitosis are as follows :

1. Helps in growth of animals and plants.
2. It replaces old and dead cells.
3. Repairs damaged and wounded tissues of animals and plants.
4. Helps in asexual reproduction in unicellular organisms.
5. Maintains same number of chromosomes in daughter cells.

5. MEIOSIS

It is the kind of cell division that produces sex cells or gametes. It takes place in the reproductive organs, i.e., testis to produce sperms and ovary to produce egg or ovum in humans. In Plants, it takes place in anthers to produce pollen grains and ovules in ovary to produce egg or oosphere. The number of chromosomes in this type of cell division is reduced to half in the daughter cells. Meiosis consists of two separate divisions of sex cells:

- (i) Meiosis I (Heterotypic or reductional division) : This division is meiotic in which the chromosome number is reduced to half (n).
- (ii) Meiosis II (Homotypic or equational division) : This division is mitotic. Each of the two cells formed in meiosis I further divides

into two, resulting in the formation of four daughter cells, each with haploid (n) number of chromosomes.

5.1 Significance of Meiosis

Significance of Mitosis are as follows :

1. In sex cells (gametes), chromosome number is halved so that on fertilization the normal number ($2n$) is restored.
2. Helps in mixing up of genes which increases the genetic vigour.
3. Helps in causing variations which further leads to evolution.

Differences between Mitosis and Meiosis are as follows :

	Mitosis	Meiosis
1.	Occurs in somatic cells of haploid as well as diploid organisms.	Occurs in reproductive cells of diploid organisms only.
2.	It produces two daughter cells.	It produces four daughter cells.
3.	It is completed in one division.	It is completed in two successive divisions.
4.	It is equational division.	It is reductional division.
5.	Genetic constitution of daughter cells remains the same.	Genetic constitution of daughter cells becomes different.
6.	No synapsis takes place.	Synapsis occurs during prophase I.
7.	No crossing over takes place.	Crossing over takes place in prophase I.
8.	It takes place during growth, repair, regeneration and development of an organism.	It takes place during reproduction of an organism.

6. CHROMOSOMES

These are small but thick, rod like darkly stainable structures seen in the nuclei of dividing cells only at metaphase and anaphase stage of cell division. Hofmeister discovered chromosomes for the first time. Each chromosome in its condensed form consists of two chromatids joined at one point called centromere and the parts of chromatids on the two sides of a centromere are called arms.

The chromosomes consist of about 40% DNA and about 60% histones (a particular type of protein). The histones and DNA form a kind of complex in which the DNA strands wind around histone molecules. Each such complex is called nucleosomes. A single human chromosome may have about a million nucleosomes.

The DNA is a very large single molecule (macromolecule) which is composed of two strands, wound around each other in a double helix manner.

6.1 Nucleic Acid

Chemical analysis of chromosomes show two nucleic acids DNA and RNA. They were first discovered by Frederick Miesher. Nucleic acids have complex chemical structures composed of pentose sugars, nitrogenous bases and phosphates. The DNA and RNA differ from each other as follows :

	DNA	RNA
1.	Found in nucleus, mitochondria and chloroplast.	Found in cytoplasm, nucleolus and chromosomes.
2.	Pentose sugar is deoxyribose.	Pentose sugar is ribose.
3.	Mostly double stranded.	Mostly single stranded.
4.	Concerned with genetic information.	Concerned with synthesis of proteins.

6.2 Genes

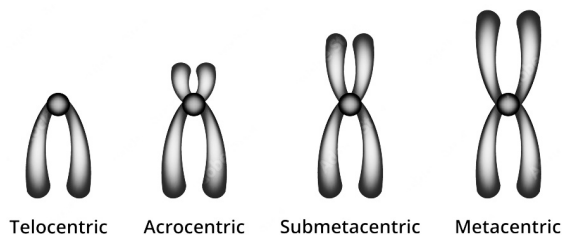
The specific parts of chromosomes, which are composed of DNA are called Genes. They determine hereditary characters. They are responsible for transmission of characters from one generation to another. They are located in the chromosomes and occupy a fixed position in the chromosome. Scientists have identified around 1,30,000 genes in human chromosomes.

Every human body cell has the same number of chromosomes and possesses nearly all normal genes. Some of the genes are active in all the cells such as genes for cell respiration, as every cell needs to respire. Some genes though present in all the cells are active only in the particular specialized body cells such as, genes for producing insulin is present in every cell but functionally it expresses only in beta cells of islets of langerhans of pancreas.

6.3 Types of Chromosomes

Chromosomes are divided in the following parts :

1. Metacentric : Centromere in the centre and two arms of chromatid are equal.
2. Submetacentric : Centromere slightly away from centre and one arm of chromatid is slightly larger than other.
3. Acrocentric Centromere is present near one end of chromatid and one arm is very large than the other.
4. Telocentric : Centromere is present at one end of chromosome.



7. TELOMERE

Telomere is terminal end of chromosome that consists of many copies of a repeated DNA sequence.

The chromosomes which determine the sex of an individual are called allosomes or idiosomes or sex chromosomes. The 23rd pair of human chromosomes (X and Y) are called as sex chromosomes.

1 – 22 pairs of human chromosomes are called as autosomes.

The chromosome number of some common animals and plants organisms in pairs are as follow :

1. Ascaris	=	1 pair
2. Frog	=	13 pairs
3. Humans	=	23 pairs
4. Gorilla	=	24 pairs
5. Rabbit	=	22 pairs
6. Rat	=	21 pairs
7. Lion, tiger and cat	=	19 pairs
8. Dog and fowl	=	39 pairs
9. Onion	=	8 pairs
10. Maize	=	10 pairs
11. Potato	=	24 pairs
12. Garden Pea	=	7 pairs

MULTIPLE CHOICE QUESTION

1. Duplicated chromosomes are joined at a point termed:

(a) Centrosome (b) Centromere
(c) Centriole (d) Chromatid

Ans :

MAIN 2024

Duplicated chromosomes consist of two identical sister chromatids joined together at a point called the centromere.

Thus (b) is correct option.

2. A female human cell divides through mitosis, maintaining the same number of chromosomes. Consider the chromosome composition of the daughter cells after mitosis. After Mitosis, a female human cell will have :

(a) 44 + XX chromosomes.
(b) 22 + X chromosomes.
(c) 22 + Y chromosomes.
(d) 44 + XY chromosomes.

Ans :

COMP 2021

If a female cell with 44+XX chromosomes divides mitotically, it will form 2 daughter cells with similar chromosomes i.e. 44+XX whereas a male cell will mitotically divide to form cells with chromosome 44+XY

Thus (a) is correct option.

3. At the end of _____ Cytokinesis is completed.
(a) Metaphase (b) Prophase
(c) Interphase (d) Telophase

Ans :

SQP 2021

Cytokinesis begins in anaphase and ends in telophase, reaching completion as the next interphase begins.

Thus (d) is correct option.

4. The nitrogenous base Adenine always pairs with _____.
(a) Thymine (b) Guanine
(c) Cytosine (d) Thiamine

Ans :

MAIN 2021

Adenine pairs with Thymine in DNA through two hydrogen bonds, maintaining the double-helix structure. This pairing follows specific base-pairing rules, ensuring accurate DNA replication. The Adenine-Thymine pairing complements the Guanine-Cytosine pairing.

Thus (a) is correct option.

5. Replication of DNA in the cell cycle occurs during the :

(a) G_1 - phase (b) Anaphase
(c) S - phase (d) G_2 - phase

Ans :

MAIN 2021

S-phase is the period during which DNA replication occurs.

Thus (c) is correct option.

6. State the functions of Centromere :

(a) It is the point of attachment of two sister chromatids.
(b) It is the point of attachment of two centrioles.
(c) It is the point of attachment of two centrosomes.
(d) It is the point of attachment between two daughter nuclei.

Ans :

COMP 2021

The centromere is a region on a chromosome that links two sister chromatids. During cell division, it also serves as the attachment point for spindle fibers, ensuring proper segregation of chromatids to daughter cells.

Thus (a) is correct option.

7. The cell component visible only during cell division _____

(a) Mitochondria (b) Chloroplast
(c) Chromosome (d) Chromatin

Ans :

SQP 2013

The genetic material, i.e. DNA, is present as chromatin fibres in a non-dividing cell. Only during particular stages of cell division are chromosomes visible. The coiling and supercoiling of chromatin fibres forms chromosomes. Because chromosomes are substantially condensed during cell division, they can be seen under a light microscope.

Thus (c) is correct option.

8. Chromosomes get aligned at the centre of the cell during :

(a) Metaphase (b) Anaphase
(c) Prophase (d) Telophase.

Ans :

SQP 2015

Attachment of chromatids to the mitotic spindle and chromatid alignment on the equatorial plate are both part of metaphase.

Thus (a) is correct option.

9. The major event that occurs during the anaphase of mitosis, which brings about the equal

distribution of chromosomes is:

(a) Splitting of the centromeres
(b) Splitting of the chromatids
(c) Replication of the genetic material
(d) Condensation of the chromatin

Ans :

MAIN 2017

Anaphase is marked by splitting of centromere and contraction of spindle fibers which in turn move the sister chromatids towards the opposite poles.

Thus (a) is correct option.

10. Which of the following descriptions of mitosis is/are correct?

(i) DNA synthesis occurs at the beginning of prophase.
(ii) The nuclear envelope breaks down in prophase and reforms in telophase.
(iii) The division of centromeres occurs in anaphase.
(a) 1, 2 and 3 (b) Only 1 and 2
(c) Only 2 and 3 (d) Only 1

Ans :

SQP 2010

Mitosis is a cell division in which a single cell divides into two identical daughter cells. In prophase, the nuclear envelope breaks down and reforms in telophase. The division of centromeres occurs in anaphase.

Thus (c) is correct option.

11. The stage in which daughter chromosomes move toward the poles of the spindle is:

(a) Anaphase (b) MetaPhase
(c) Prophase (d) TeloPhase

Ans :

COMP 2022

In anaphase, the centromere splits and chromosomes move apart towards two opposite poles due to shortening of spindle fibers.

Thus (a) is correct option.

12. During cell division, a specific cell component becomes distinctly visible, aiding in the distribution of genetic material. This component is otherwise not clearly seen in non-dividing cells. The cell component visible only during cell division.

(a) Mitochondria (b) Chloroplast
(c) Chromosome (d) Chromatin

Ans :

MAIN 2019

The cell component visible only during cell division is the chromosome. The highly condensed

and coiled chromatin fibers which appear during karyokinesis are called chromosomes.

Thus (c) is correct option.

- 13.** Which of the events listed below is not observed during mitosis?

- (a) Chromatin condensation
- (b) Movement of centrioles to opposite poles
- (c) Appearance of chromosomes with two chromatids joined together at the centromere.
- (d) Crossing over

Ans :

SQP 2005

Crossing over occurs during prophase I of meiosis. Thus (d) is correct option.

- 14.** Which kind of cell division taking place in each of the following options is incorrect?

- (a) At the tip of the root : Mitosis
- (b) To produce pollen grains : Meiosis
- (c) To add girth to the stem : Mitosis
- (d) To produce egg: Mitosis

Ans :

COMP 2009

Female gametes are called ova or egg cells and male gametes are called sperm. These reproductive cells are produced through a type of cell division known as meiosis.

Thus (d) is correct option.

- 15.** Which of the following options are the pyrimidine bases found in DNA?

- (a) Uracil and Thymine
- (b) Thymine and Cytosine
- (c) Adenine and Thymine
- (d) Cytosine and Uracil

Ans :

SQP 2020

The pyrimidine bases present in the DNA are cytosine and thymine. Apart from the pyrimidine bases, purine bases are also present — adenine and guanine.

Thus (b) is correct option.

- 16.** Chromosomes and genes both play a crucial role in inheritance and cellular function. During cell division, they ensure the transfer of genetic information to daughter cells, maintaining consistency across generations Which statement is true of both chromosomes and genes?

- (a) Each codes for a specific protein.
- (b) Each may be copied and passed on in mitosis.
- (c) Each may be either dominant or recessive.
- (d) Each may exist as two or more alleles.

Ans :

MAIN 2002

Mitosis is used to produce daughter cells that are genetically identical to the parent cells. The cell copies – or ‘replicates’ - its chromosomes (as well as the genes), and then splits the copied chromosomes equally to make sure that each daughter cell has a full set.

Thus (b) is correct option.

- 17.** Spindle fibres play an important role in mitosis and meiosis. Which biological molecule are spindle fibres composed of?

- (a) Polysaccharide
- (b) Protein
- (c) nucleic acid
- (d) Lipid

Ans :

SQP 2000

Spindle fibers also known as mitotic spindle are the cellular structures which are mainly used during cell division. It forms a protein structure which helps in cell division. It is made up of tubulin protein.

Thus (b) is correct option.

- 18.** Two daughter cells formed during mitosis contain

- (a) the same amount of DNA, S but a set of chromosomes different from those of the parent cell.
- (b) the same amount of DNA and the same set of chromosomes as those of the parent cell.
- (c) half the amount of DNA and the same set of chromosomes as those of the parent cell.
- (d) double the amount of DNA and a set of chromosomes different from those of the parent cell.

Ans :

SQP 2008

Thus (b) is correct option.

- 19.** Abnormal and uncontrolled mitosis in an organ will result in:

- (a) gamete
- (b) Zygote
- (c) Cancer
- (d) None of these

Ans :

MAIN 2010

Cancer is a group of diseases characterized by uncontrolled cell division —mitosis.

Thus (c) is correct option.

- 20.** Meiotic division occurs in

- (a) vegetative cells
- (b) reproductive cells
- (c) meristematic cells
- (d) none of these.

Ans :

SQP 2016

The meiotic division takes place in the reproductive cells.

Thus (b) is correct option.

- 21.** Identify the wrong statement about meiosis:
- Pairing of homologous chromosomes.
 - Four haploid cells are formed.
 - At the end of meiosis the number of chromosomes are reduced to half.
 - Two cycle of DNA replication occurs.

Ans : MAIN 2003

S phase (Synthesis Phase) is the phase of the cell cycle in which DNA is replicated, occurring between G_1 phase and G_2 phase.

Thus (d) is correct option.

- 22.** What defines a diploid nucleus?
- A nucleus containing two unpaired chromosomes.
 - A nucleus with two alternative forms of a gene.
 - A nucleus with two separate threads of DNA.
 - Anucleus containing two sets of chromosomes.

Ans : SQP 2008

A diploid nucleus describes a cell, nucleus, or organism containing two sets of chromosomes ($2n$).

Thus (d) is correct option.

- 23.** When a cell divides, these events occur.
- The DNA inside the cell is duplicated exactly.
 - Daughter cells are produced with the same chromosome number as the parent cell.

Which type of division has occurred?

- Meiosis producing genetically different cells.
- Meiosis producing genetically identical cells.
- Mitosis producing genetically different cells.
- Mitosis producing genetically identical cells.

Ans : COMP 2001

During mitosis, the following events takes place:

- The DNA inside the cell is duplicated exactly.
- Daughter cells are produced with the same chromosome number as the parent cell.

Thus (d) is correct option.

- 24.** If you are provided with root-tips of onion in your class and are asked to count the chromosomes which of the following stages can you most conveniently look into:
- Prophase
 - Anaphase
 - Telophase
 - Metaphase

Ans :

SQP 2017

Metaphase is the best time to count and study the number and morphology of chromosomes.

Thus (d) is correct option.

- 25.** Which of the following bonds are broken during DNA replication?
- Hydrogen bonds between bases.
 - Phosphodiester bonds.
 - Covalent bonds between bases.
 - Ionic bonds between bases and phosphate groups.

Ans : MAIN 2022

During DNA replication, the hydrogen bonds must be broken between the complementary nitrogenous bases in the DNA double helix. Once this is accomplished, either side of the DNA molecule can act as a template to produce another double stranded DNA molecule.

Thus (a) is correct option.

- 26.** Which of the following is incorrect regarding structure of DNA?
- Nucleotide is composed of pentose sugar, nitrogenous bases and phosphate group.
 - Adenine pairs with Thymine and Guanine pairs with Cytosine.
 - $A = T, C = G$
 - DNA strand winds around the nucleosome, which consists of eight pairs of histone proteins.
 - Genes are the fundamental unit of DNA.
- (ii) and (iii) only
 - (i), (ii), (v) only
 - (iii) and (iv) only
 - None of them

Ans : COMP 2020

The bases on the opposite strands are connected through hydrogen bonds forming base pairs (bp). Adenine always forms two hydrogen bonds with thymine from the opposite strand and vice-versa. Guanine forms three hydrogen bonds with cytosine from the opposite strand and vice-versa. A nucleosome is a section of DNA that is wrapped around a core of proteins. Thus, option (iii) and (iv) are incorrect.

Thus (c) is correct option.

- 27.** How does a haploid nucleus differ from a diploid nucleus of the same species?
- It has different genes.
 - It has fewer chromosomes.
 - It has more alleles.
 - It is the result of fertilisation.

Ans :

MAIN 2023

The haploid nucleus has half the chromosomes present in a diploid nucleus.

Thus (b) is correct option.

28. Which of these structures, involved in cell division, is present in animal cells but not higher plant cells?

- (a) Centriole
- (b) Centromere
- (c) Chromatid
- (d) Chromosome

Ans :

SQP 2018

Paired organelles called centrioles, typically found together near the nucleus in the centrosome, exist primarily in animal cells and serve to control spindle fibre formation and which later has an effect on chromosome separation. Centrioles are absent from the cells of higher plants.

Thus (a) is correct option.

29. Chromosomes get aligned at the centre of the cell during :

- (a) Metaphase
- (b) Anaphase
- (c) Prophase
- (d) Telophase

Ans :

MAIN 2014

During metaphase, the cell's chromosomes align themselves in the middle of the cell through a type of cellular "tug of war." The chromosomes, which have been replicated and remain joined at a central point called the centromere, are called sister chromatids.

Thus (a) is correct option.

30. What is produced when a cell undergoes mitosis once?

- (a) Four new cells which are different from each other and from their parent cell.
- (b) Four new cells which are identical to each other and to their parent cell.
- (c) Two new cells which are different from each other and from their parent cell.
- (d) Two new cells which are identical to each other and to their parent cell.

Ans :

SQP 2018

A cell undergoes mitosis to produce two (daughter) cells that are genetically identical to the original (parent) cell.

Thus (d) is correct option.

31. The two chromatids of a metaphase chromosome represent:

- (a) Homologous chromosome of a diploid set.
- (b) Replicated chromosomes to be separated at anaphase.
- (c) Non-homologous chromosomes joined at the centromere.
- (d) Maternal and paternal chromosomes joined at the centromere.

Ans :

COMP 2013

A chromosome consists of two sister chromatids joined at the centromere. In the anaphase stage, the centromere splits and the two sister chromatids move to opposite poles.

Thus (b) is correct option.

32. Select the correct statement about G_1 phase:

- (a) Cell is metabolically inactive.
- (b) DNA in the cell does not replicate.
- (c) It is not a phase of synthesis of macromolecules.
- (d) Cell stops growing.

Ans :

MAIN 2007

The G_1 phase is the first of four phases of the cell cycle that takes place in eukaryotic cell division. In this part of interphase, the cell synthesizes m RNA and proteins in preparation for subsequent steps leading to mitosis. DNA in the cell replicates in the S-phase.

Thus (b) is correct option.

33. Cytokinesis is the division of

- (a) nucleus
- (b) cytoplasm
- (c) nucleoplasm
- (d) none of these.

Ans :

SQP 2016

Cytokinesis is the physical process of cell division, which divides the cytoplasm of a parental cell into two daughter cells. It occurs concurrently with two types of nuclear division called mitosis and meiosis, which occur in animal cells.

Thus (b) is correct option.

34. Cell division by meiosis of a parent cell with 23 pairs of chromosomes will result in:

- (a) 2 cells, each with 23 pairs of chromosomes.
- (b) 2 cells, each with 23 single chromosomes.
- (c) 4 cells, each with 23 pairs of chromosomes.
- (d) 4 cells, each with 23 single chromosomes.

Ans :

COMP 2023

In meiosis the parent cell divides twice to form four cells, each with a single set of chromosomes (haploid).

This means the chromosome number will be halved to 23 single chromosomes.

Thus (d) is correct option.

- 35.** How many mitotic divisions of a meristematic cell in a root tip are needed to produce 256 daughter cells?

(a) 8 (b) 16
(c) 32 (d) 64

Ans : SQP 2002

Every mitotic division will lead to the formation of twice the number of mother cells, hence to form 256 cells from a root tip cell, 8 generations of mitotic divisions must occur ($2^8 = 256$ cells).

Thus (a) is correct option.

- 36.** Equatorial plane is formed in:

(a) Anaphase (b) Metaphase
(c) Telophase (d) Interphase

Ans : COMP 2009

During metaphase, all the chromosomes are aligned on a plane called the metaphase plate, or the equatorial plane, midway between the two poles of the cell.

Thus (b) is correct option.

- 37.** During Telophase, the

(a) nuclear membrane is formed
(b) nucleolus appears
(c) astral rays disappear
(d) all of these

Ans : SQP 2001

During telophase, a nuclear membrane forms around each set of chromosomes to separate the nuclear DNA from the cytoplasm. The chromosomes begin to uncoil, which makes them diffuse and less compact.

Thus (d) is correct option.

- 38.** The following features are shown by the dividing cell in a stage of mitosis: the nuclear membrane reappears; spindle fibres disappear; chromatids become thin; daughter nuclei are formed. Which stage is being discussed here?

(a) Prophase (b) Metaphase
(c) Anaphase (d) Telophase

Ans : MAIN 2010

During telophase, the chromosomes begin to decondense, the spindle breaks down, and the nuclear membranes and nucleoli re-form. The cytoplasm of the mother cell divides to form two

daughter cells, each containing the same number and kind of chromosomes as the mother cell.

Thus (d) is correct option.

- 39.** Which of the following might you find in the backbone of DNA?

1. Phosphate group
2. Hexose sugar
3. Adenine
(a) 1, 2 and 3 (b) 1 only
(c) 2 only (d) 1 and 2

Ans : SQP 2002

The backbone of a DNA molecule consists of the phosphate groups and the deoxyribose sugars, whereas the base region of the DNA molecule consists of the nitrogenous bases; therefore, the backbone of DNA is made up of phosphate groups and pentose sugars. Adenine is part of the base region of the molecule. DNA does not contain any hexose (six-carbon) sugars.

Thus (b) is correct option.

- 40.** At which stage in mitosis and meiosis do chromosomes always line up at the equator of the spindle?

(a) Prophase (b) Telophase
(c) Anaphase (d) Metaphase

Ans : SQP 2014

During metaphase, spindle fibers attach to the centromere of each pair of sister chromatids. The sister chromatids line up at the equator, or center, of the cell.

Thus (d) is correct option.

- 41.** Which statement describes human cells formed by meiosis?

(a) They are genetically identical and they become gametes.
(b) They are genetically identical and they become tissues.
(c) They are not genetically identical and they become gametes.
(d) They are not genetically identical and they become tissues.

Ans : MAIN 2012

In meiosis, the parent cell divides twice to form four cells, each with a single set of chromosomes (haploid). The gametes produced by meiosis are not identical because recombination of alleles (genes) present on two homologous chromosomes occurs during meiosis.

Thus (c) is correct option.

- 42.** Which of the following cellular structures always disappears during mitosis and meiosis?
- Plasma membrane
 - Nucleolus and nuclear envelope
 - Plastids
 - None of these

Ans :

SQP 2015

The cellular structure that disappears during mitosis is nuclear membrane and nucleolus. The cell then divides by cytokinesis to produce two genetically identical daughter cells. So, the correct answer is 'Nuclear membrane and nucleolus'.

Thus (b) is correct option.

- 43.** A cell has five pairs of chromosomes. After mitotic division, the number of chromosomes in the daughter cells will be:
- Five
 - Ten
 - Twenty
 - Forty

Ans :

SQP 2006

The movement of chromatids is carried out by spindle fibers. If the cell has 5 chromosomes, during the S-phase it replicates. So, the number of chromosomes entering mitosis will be 10 chromosomes. During anaphase chromosomes split into chromatids.

Thus (b) is correct option.

- 44.** Which phase comes between G_1 and G_2 phase?
- G_0 phase
 - M – phase
 - S- phase
 - Interphase

Ans :

MAIN 2021

The interphase of the cell cycle comprises G_1 , S and G_2 phase. The S-phase separates the two growth phases.

Thus (c) is correct option.

- 45.** Some features of cell division are listed.
- Haploid cells are produced
 - New cells are genetically identical
 - Reduction division
 - Results in variation

Which features would be associated with meiosis?

- (i), (ii) and (iii)
- (i), (ii) and (iv)
- (i), (iii) and (iv)
- (ii), (iii) and (iv)

Ans :

SQP 2018

During meiosis a diploid cell divides twice to form four daughter cells. These four daughter cells have half the number of chromosomes of the parent cell they are haploid. Meiosis produces sex cells

or gametes. Meiosis create genetic variation by making new combinations of gene variants.
Thus (c) is correct option.

- 46.** Duplicated chromosomes are joined at a point termed:
- Centrosome
 - Centromere
 - Centriole
 - Chromatid

Ans :

COMP 2013

The centromere is the region where two sister chromatids are connected in a duplicated chromosome, ensuring correct attachment to spindle fibers during cell division.

Thus (b) is correct option.

- 47.** What is not a function of meiosis?
- Producing genetically different cells
 - Producing nuclei in ovules
 - Producing sperm cells
 - Repairing damaged tissues

Ans :

COMP 2002

Repairing damaged tissues is the function of mitosis.

Thus (d) is correct option.

- 48.** A complex consisting of DNA strand and a core of histones is _____
- Nucleotide
 - Nucleosome
 - Centrosome
 - Chromosome

Ans :

COMP 2005

Nucleosome is a complex structure in which DNA wraps around a protein core of eight histone molecules.

Thus (b) is correct option.

- 49.** Meiosis _____ the parental chromosome number.
- Doubles
 - Reduces
 - Maintains
 - Stabilises

Ans :

SQP 2000

Meiosis is a type of cell division that reduces the number of chromosomes in the parent cell by half and produces four gamete cells.

Thus (b) is correct option.

- 50.** _____ occupies the longest "period in a cell cycle."
- Interphase
 - Prophase
 - Metaphase
 - Telophase

Ans :

MAIN 2009

During interphase, the cell undergoes normal growth processes while also preparing for cell division. It is the longest phase of the cell cycle, cell spends approximately 90% of its time in this phase.

Thus (a) is correct option.

51. Synthesis phase in the cell cycle is called so, because of the synthesis of more _____
 (a) RNA (b) RNA and Proteins
 (c) DNA (d) Glucose

Ans :

COMP 2011

Before the start of karyokinesis, DNA duplication or semi-conservative replication occurs during the synthesis phase of interphase.

Thus (c) is correct option.

52. The cell component visible only during cell division:
 (a) Chromosome (b) Chromoplast
 (c) hromatin (d) Centriole

Ans :

MAIN 2018

The cell component visible only during cell division is chromosome. In a non-dividing cell, DNA is present as chromatin fibres. Chromosomes are formed by coiling and supercoiling of chromatin fibres. Since, during cell division, chromosomes are highly condensed, they are visible under light microscope.

Thus (a) is correct option.

53. Match the events given in Column A with the phase in mitotic cell division in Column B and select the correct option.

	Column A		Column B
(i)	Chromosomes get arranged in a horizontal plane at the equator.	(A)	Anaphase
(ii)	Daughter chromosomes move to the opposite poles of a spindle.	(B)	Prophase
(iii)	Chromosomes become visible as fine long threads	(C)	Telophase
(iv)	Chromosomes lose their distinctiveness and gradually become transformed into a chromatin network	(D)	Metaphase

- (a) (i) - (B), (ii) - (C), (iii) - (D), (iv) - (A)
 (b) (i) - (D), (ii) - (A), (iii) - (B), (iv) - (C)
 (c) (i) - (B), (ii) - (A), (iii) - (D), (iv) - (C)
 (d) (i) - (D), (ii) - (A), (iii) - (C), (iv) - (B)

Ans :

SQP 2014

In metaphase, chromosomes get arranged in a horizontal plane at the equator. Daughter chromosomes move to the opposite poles of a spindle in anaphase.

Chromosomes become visible as fine long threads in prophase. Chromosomes lose their distinctiveness and gradually become transformed into a chromatin network in telophase.

Thus (b) is correct option.

54. Chromosomes get aligned at the centre of the cell during _____
 (a) Metaphase (b) Anaphase
 (c) Prophase (d) Telophase

Ans :

COMP 2022

During metaphase, each chromosome gets attached to the spindle by its centromere. The chromosomes line up in the centre at the equatorial plane.

Thus (a) is correct option.

55. The type of cell division that leads to the formation of two identical daughter cells is _____
 (a) Mitosis
 (b) Genetic recombination
 (c) Meiosis
 (d) Cytokinesis

Ans :

SQP 2021

Mitosis is a process of nuclear division in eukaryotic cells that occurs when a parent cell divides to produce two identical daughter cells.

Thus (a) is correct option.

56. G_1 , S and G_2 are phases present in _____.
 (a) prophase (b) interphase
 (c) metaphase (d) anaphase.

Ans :

MAIN 2001

A typical cell cycle comprises of interphase and mitosis. Interphase comprises of G_1 or first growth phase, Synthesis or S phase and second growth phase or G_2 phase. G_1 phase starts after cytokinesis, S phase starts after G_1 phase and is followed by second growth phase or G_2 phase.

Thus (b) is correct option.

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DIRECTION : Complete the following statements with appropriate option .

57. DNA content doubles during _____
 (a) Interphase (b) Prophase
 (c) Metaphase (d) Growth phase

Ans :

COMP 2012

During a mitotic cell cycle, the DNA content per chromosome doubles during S phase (each chromosome starts as one chromatid, then becomes a pair of identical sister chromatids during S phase), but the chromosome number stays the same.

Thus (a) is correct option.

58. The disappearance of spindle and uncoiling of chromosomes takes place in:

- (a) Anaphase (b) Telophase
 (c) Pachytene (d) Meiosis

Ans :

SQP 2018

Telophase is the fifth and final phase of mitosis. During telophase, the chromosomes begin to uncoil, the spindle breaks down, and the nuclear membranes and nucleoli reform. The cytoplasm of the mother cell divides to form two daughter cells, each containing the same number and kind of chromosomes as the mother cell.

Thus (b) is correct option.

59. A duplicated chromosome has _____ chromatids

- (a) One (b) Two
 (c) Three (d) Four

Ans :

COMP 2004

A single part of the duplicated chromosome is known as the chromatid which is separated during the cell division and each cell gets one chromatid. Thus, the duplicated chromosome has two sister chromatids.

Thus (b) is correct option.

60. Mitosis is characterised by _____

- (a) Reduction division
 (b) Equal division
 (c) Both reduction and equal division
 (d) Pairing of homologous chromosomes

Ans :

SQP 2009

Mitosis is characterised by equal division because the chromosome number in the daughter cells remain same as that of parent cell.

Thus (b) is correct option.

61. The exchange of chromatid parts between the maternal and the paternal chromatids of a pair of a homologous chromosomes during meiosis is _____

- (a) Crossing over
 (b) Karyokinesis
 (c) Meiosis
 (d) Cytokinesis

Ans :

MAIN 2002

Crossing over or recombination is the exchange of chromosome segments between non-sister chromatids in meiosis. Crossing over creates new combinations of genes in the gametes that are not found in either parent, contributing to genetic diversity.

Thus (a) is correct option.

62. _____ is not a stage of mitosis.

- (a) prophase (b) Interphase
 (c) Metaphase (d) Anaphase

Ans :

COMP 2010

Interphase is technically not part of mitosis, but rather encompasses stages G_1 , S, and G_2 of the cell cycle. In interphase, the cell is engaged in metabolic activity and prepares for mitosis.

Thus (b) is correct option.

63. The period between two successive mitotic divisions is :

- (a) Diakinesis (b) Interphase
 (c) Anaphase (d) Mitosis

Ans :

SQP 2004

The period between two successive mitotic divisions is interphase. It is also called resting phase and includes all the changes that takes place in a newly formed cell before it becomes capable of division.

Thus (b) is correct option.

64. Lateral pairing of homologous chromosomes is known as _____

- (a) Recombination (b) Chiasmata
 (c) Cross over (d) Synapsis

Ans :

COMP 2007

Synapsis is the pairing of two chromosomes that occurs during meiosis. It allows matching-up of homologous pairs prior to their segregation and possible chromosomal crossover between them. Synapsis takes place during prophase I of meiosis. Thus (d) is correct option.

65. The period of rest between two successive cell divisions is _____.
 (a) Karyokinesis
 (b) Interphase
 (c) Prophase
 (d) Dikaryophase

Ans :

MAIN 2019

The period between two successive cell divisions is called interphase or the resting phase.

Thus (b) is correct option.

66. In complementary base pairing of DNA, guanine always pairs with _____ and adenine always pairs with _____.
 (a) Cytosine, uracil
 (b) Cytosine, thymine
 (c) Thymine, cytosine
 (d) Guanine, adenine

Ans :

COMP 2021

The four nitrogenous bases of DNA are thymine, adenine, guanine and cytosine. Guanine and cytosine are bound together by three hydrogen bonds; whereas, adenine and thymine are bound together by two hydrogen bonds. This is known as complementary base pairing.

Thus (b) is correct option.

67. A pair of corresponding chromosomes of the same shape and size but one from each parent.
 (a) Autosomes
 (b) Sex chromosomes
 (c) Homologous chromosomes
 (d) Analogous chromosomes

Ans :

SQP 2002

Homologous chromosomes are a pair of corresponding chromosomes of the same shape, size and length containing the same genes in the same order, one from each parent. During fertilisation if pairing between sex chromosomes of same shape and size occurs such pairing is called homologous pairing and chromosomes are called homologous chromosomes.

Thus (c) is correct option.

68. Meiosis in diploid organisms results in _____.
 (a) Production of gametes
 (b) Reduction in the number of chromosomes
 (c) Introduction of variation
 (d) All of the above

Ans :

MAIN 2008

Meiosis is cell division responsible for production

of gametes through reductional division which result in halving of the number of chromosomes. Meiosis results in the formation of gametes. Thus (d) is correct option.

69. Centromere is concerned with _____.
 (a) Duplication of DNA
 (b) Formation of spindle fibres
 (c) Splitting of chromosomes
 (d) Replication of DNA

Ans :

SQP 2017

A centromere is a region of DNA that is responsible for the movement of the replicated chromosomes into the two daughter cells by splitting of chromosomes.

Thus (c) is correct option.

70. The nuclear membrane disappears completely during _____.
 (a) Early prophase
 (b) Later prophase
 (c) Metaphase
 (d) Telophase

Ans :

MAIN 2002

Nuclear membrane starts disappearing at the start of mitosis and by the late prophase it disappears completely along with the major cell organelles.

Thus (b) is correct option.

71. Network of long, thin, dark staining fibres seen in the interphase nucleus is _____.
 (a) Synapsis
 (b) Chromatin fibres
 (c) Nucleosome
 (d) Nucleotide

Ans :

SQP 2006

In inter-phase, the nucleus shows a network of very long extremely thin dark staining fibres called as chromatin fibres. Chromosomes are the high condensed coiled chromatin fibres.

Thus (b) is correct option.

72. Cells which are not dividing are likely to be at _____.
 (a) G_1 (b) G_2
 (c) G_0 (d) S phase

Ans :

COMP 2012

Cells that do not divide further exit G_1 phase to enter an inactive stage and called quiescent stage G_0 of the cell cycle.

Thus (c) is correct option.

73. Spindle Fibres

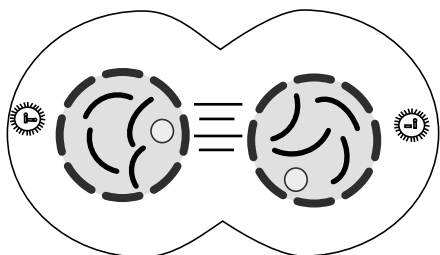
- (a) Helps to divide the nucleus equally in the daughter cells from the parent cell.
- (b) Helps to divide the cytoplasm in the daughter cells from the parent cell.
- (c) Helps to divide the chromosome equally in the daughter cells from the parent cell.
- (d) Helps to divide the centrosome equally in the daughter cells from the parent cell.

Ans :

SQP 2005

Spindle fibres helps to divide the chromosome equally in the daughter cells from the parent cell during both types of nuclear division: mitosis and meiosis.

Thus (c) is correct option.

74. Given below is a diagram representing a stage during the mitotic cell division. Which one of the following option is the correct stage?

- (a) Prophase
- (b) Metaphase
- (c) Anaphase
- (d) Telophase

Ans :

SQP 2001

During telophase, Chromosome sets assemble at opposite poles, a nuclear envelope reforms around each set and cytokinesis (division of the cytoplasm) usually follows.

Thus (d) is correct option.

75. Ribosomes

- (a) Scattered inside the cell
- (b) Scattered inside the plasma membrane
- (c) Scattered inside the nucleus
- (d) Scattered in the cytoplasm

Ans :

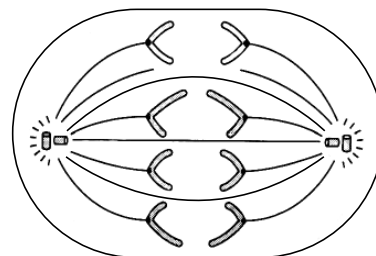
MAIN 2007

Ribosomes are small granules which are found scattered in the cytoplasm. They are single walled spherical bodies composed mainly of RNA.

Thus (d) is correct option.

76. Given below is a diagram representing a stage during the mitotic cell division. Which one of the following option is the correct stage as per the

description?



- (a) Anaphase, as chromatids are being pulled towards the opposite poles.
- (b) Metaphase, as chromosomes are in the equatorial plane.
- (c) Anaphase, as chromosome gets attached to spindle by its centromere.
- (d) Telophase, as the chromatids has reached the two poles.

Ans :

SQP 2004

During anaphase the centromeres divide and the chromatids start moving towards the two opposite poles.

Thus (a) is correct option.

77. Chromosomes

- (a) Thread-like structure found in DNA that carry genetic information of an organism in the form of genes.
- (b) Ring-like structure found in RNA that carry genetic information of an organism in the form of genes.
- (c) Thread-like structure found in both DNA and RNA that carry genetic information of an organism in the form of genes.
- (d) Thread-like structure found in RNA that carry genetic information of an organism in the form of genes.

Ans :

SQP 2014

Chromosomes are thread-like structure found in DNA that carry genetic information of an organism in the form of genes. Different organisms have different numbers of chromosomes. Humans have 23 pairs of chromosomes—22 pairs of numbered chromosomes, called autosomes, and one pair of sex chromosomes, X and Y.

Thus (a) is correct option.

78. Chromosomes

- (a) The carriers of heredity
- (b) The controlling centre of the cell
- (c) The site for various chemical reactions
- (d) Intracellular digestion.

Ans :

SQP 2023

Chromosomes are the carriers of heredity which means they are responsible to provide hereditary characteristics and genetic information to the various cells.

Thus (a) is correct option.

79. Spindle fibres

- (a) Between the two centrioles
- (b) Between the two centrosomes
- (c) Between chromatid and centromere
- (d) Between two centromeres

Ans :

MAIN 2018

They appear between the two daughter centrioles and is necessary to equally divide the chromosomes in a parental cell into two daughter cells during both types of nuclear division mitosis and meiosis. Thus (a) is correct option.

80. Cytoplasm.

- (a) Inside the cell between the nucleolus and the centromere
- (b) Inside the cell between the nucleus and the cell membrane
- (c) Inside the cell between the mitochondria and the cell membrane.
- (d) Inside the cell near to the cell membrane

Ans :

MAIN 2001

Cytoplasm is located inside the cell between the nucleus and the cell membrane. It comprises gel-like substance called cytosol and the various cell organelles (the cell's internal sub-structures).

Thus (b) is correct option.

81. Chromosomes

- (a) In the cytoplasm of plant and animal cell.
- (b) In the centrosome of plant and animal cell.
- (c) In the RNA of plant and animal cell.
- (d) In the nucleus of plant and animal cell.

Ans :

COMP 2010

Chromosomes are thread like structures located inside the nucleus of animal and plant cells. Each chromosome is made of protein and a single molecule of deoxyribonucleic acid (DNA).

Thus (d) is correct option.

82. Genes

- (a) Help in carrying gametes
- (b) Encode fats and lipids
- (c) Encode particular protein
- (d) Help in DNA replication

Ans :

MAIN 2007

They give instructions for a living being to make molecules called proteins. In other words, they encode particular protein which express in the form of some particular feature of the body.

Thus (c) is correct option.

83. Nucleus

- (a) Centre of the cytoplasm
- (b) Between the cell membrane and cytoplasm
- (c) Equator of the cell
- (d) Between nucleolus and cell membrane

Ans :

COMP 2010

Nucleus is a large spherical body found at the centre of the cytoplasm. It regulates all the cell function.

Thus (a) is correct option.

84. Centromeres.

- (a) It is a part of nucleus through which chromosomes are linked.
- (b) It is a part of chromosome through which chromatids are linked.
- (c) It is a part of DNA through which chromatids are linked.
- (d) It is a part of RNA through which chromosomes are linked.

Ans :

COMP 2006

Centromere is a structure in a chromosome that holds together the two chromatids (the daughter strands of a replicated chromosome).

Thus (b) is correct option.

85. Meiosis

- (a) A process where a single cell divides twice to produce four cells containing half the original amount of genetic information.
- (b) A process where a nucleus divides twice to produce four cells containing the original amount of genetic information.
- (c) A process where a cell divides thrice to produce four cells containing half the original amount of genetic information.
- (d) A process where a DNA divides twice to produce eight cells containing half the original amount of genetic information.

Ans :

MAIN 2020

Meiosis is a process where a single cell divides twice to produce four cells containing half the original amount of genetic information. These cells are sex cells i.e., sperms in males and eggs in females.

Thus (a) is correct option.

86. Gene

- (a) Physical and functional unit of heredity that carries DNA material from one generation to the next.
- (b) Physical and functional unit of heredity that carries chromosomes from one generation to the next.
- (c) Physical and functional unit of heredity that carries gametes from one generation to the next.
- (d) Physical and functional unit of heredity that carries genetic information from one generation to the next.

Ans :

COMP 2022

The fundamental unit of heredity that carries genetic information from one generation to the next. A gene is an ordered sequence of nucleotides located on a particular position on a particular chromosome that encodes a specific functional protein.

Thus (d) is correct option.

87. Mitosis

- (a) A process of cell replication during which one cell gives rise to two non-identical daughter cells.
- (b) A process of fission of cell during which one cell gives rise to three genetically identical daughter cells.
- (c) A process of nuclear division during which one cell gives rise to two genetically identical daughter cells.
- (d) A process of cell division during which one cell gives rise to four genetically identical daughter cells.

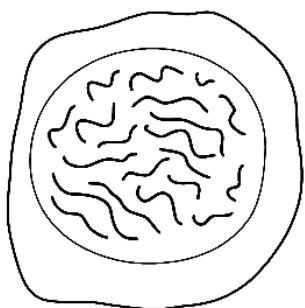
Ans :

MAIN 2000

Mitosis, a process of nuclear division during which one cell gives rise to two genetically identical daughter cells. It has four stages prophase, metaphase, anaphase and telophase.

Thus (c) is correct option.

- 88.** The diagram shows a cell of an organism formed by reduction division. The nucleus contains 20 chromosomes



What is the diploid number for this organism?

- (a) 10
- (b) 20
- (c) 40
- (d) 46

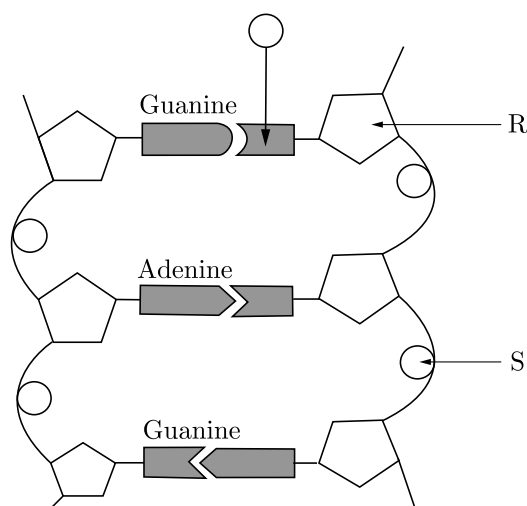
Ans :

COMP 2017

The haploid number is exactly half the total number of chromosomes present in the organism's somatic cells and results due to reduction division (meiosis). As the nucleus contains 20 chromosomes the diploid number will be twice that of the haploid cell, i.e., 40.

Thus (c) is correct option.

- 89.** In the following diagram of a section of a DNA molecule, what is the part labelled Q?



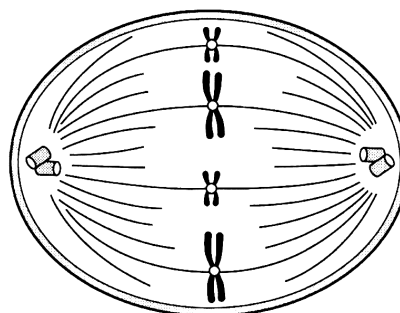
- (a) Adenine
- (b) Cytosine
- (c) Thymine
- (d) Uracil

Ans :

SQP 2001

In base pairing, adenine always pairs with thymine, and guanine always pairs with cytosine. Thus (b) is correct option.

- 90.** The diagram given below represents a stage during cell division. Which stage is depicted and name the stage that comes before the stage shown?



- (a) Metaphase, Prophase
- (b) Metaphase, Anaphase
- (c) Anaphase, Metaphase
- (d) Anaphase, Telophase

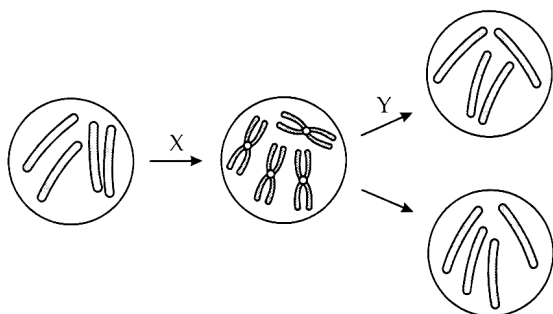
Ans :

SQP 2009

Metaphase is marked by the arrangement of chromosomes on the equator of spindle. Prophase is the stage which comes before Metaphase.

Thus (a) is correct option.

91. The diagram shows the formation of new diploid cells.



What do arrows X and Y represent?

	X	Y
(a)	Duplication of chromosomes	meiosis
(b)	Duplication of chromosomes	meiosis
(c)	Meiosis	duplication of chromosomes
(d)	Mitosis	duplication of chromosomes

Ans :

COMP 2013

In mitosis, chromosome duplication occurs during interphase. Mitosis is a part of the cell cycle in which replicated chromosomes are separated into two new nuclei.

Thus (b) is correct option.

92. Golgi Apparatus

- (a) Synthesis of respiratory enzymes
- (b) Synthesis and secretion of enzymes, hormones etc.
- (c) Synthesis of Protein.
- (d) Regulates cell function

Ans :

SQP 2017

Golgi apparatus are stacks of flattened membrane sacs that helps in the synthesis and secretion of

enzymes, hormones etc.

Thus (b) is correct option.

93. DNA

- (a) Controls functioning of RNA
- (b) Controls biosynthetic processes of cell.
- (c) Stores all of the genetic information
- (d) Controls mitotic and meiotic division.

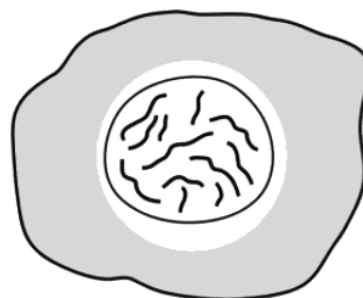
Ans :

MAIN 2010

The function of DNA is to store all of the genetic information that an organism needs to develop, function and reproduce.

Thus (c) is correct option.

94. The diagram shows a cell of an organism. The nucleus contains 12 chromosomes.



After it divides by mitosis, how many chromosomes would be present in one of the daughter cells?

- (a) 6
- (b) 12
- (c) 18
- (d) 24

Ans :

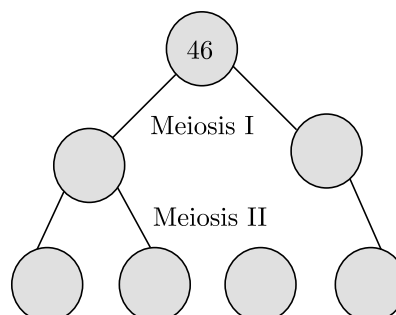
COMP 2007

During mitosis, a cell duplicates all of its contents, including its chromosomes, and splits to form two identical daughter cells with the same number of chromosomes.

At the end of mitosis, the two daughter cells will be exact copies of the original cell. Each daughter cell will have 12 chromosomes.

Thus (b) is correct option.

95. The diagram shows stages of meiosis in a human testis:



	After meiosis I	After meiosis II
(a)	46	46
(b)	46	23
(c)	23	46
(d)	23	23

Ans :

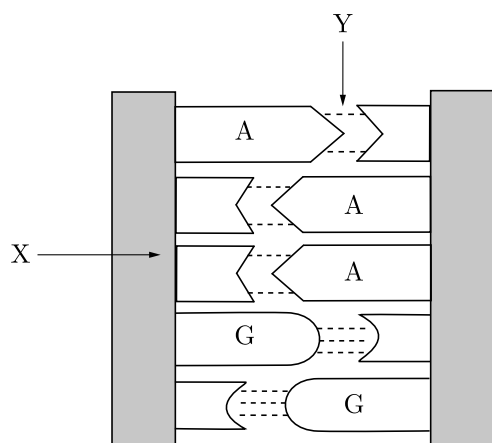
SQP 2015

A human cell has 46 total or 23 pairs of chromosomes. The first division is called the reduction division or meiosis

I — because it reduces the number of chromosomes from 46 chromosomes or $2n$ to 23 chromosomes or n . Meiosis II resembles a mitotic division, and after meiosis II, 23 chromosomes results.

Thus (d) is correct option.

96. In the diagram given below of a section of a DNA molecule, which are the two components of part X?



- (a) Ribose and Phosphate
 (b) Guanine and Phosphate
 (c) Deoxyribose and Thymine
 (d) Deoxyribose and Phosphate

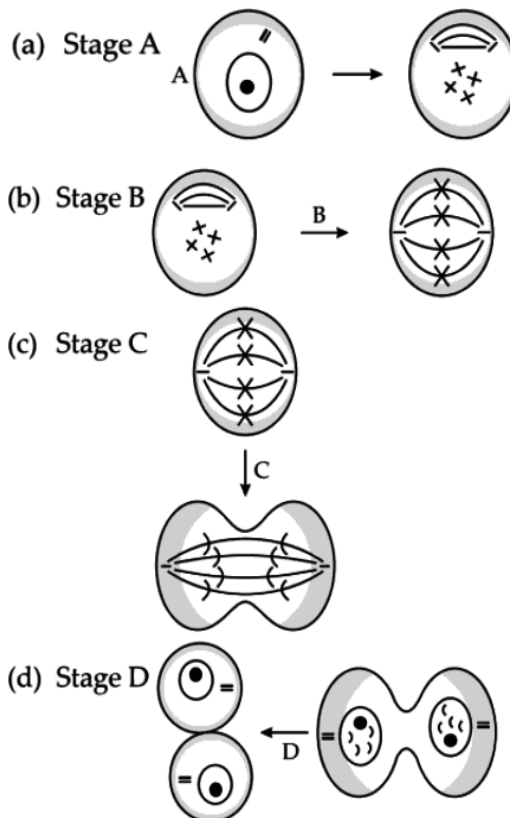
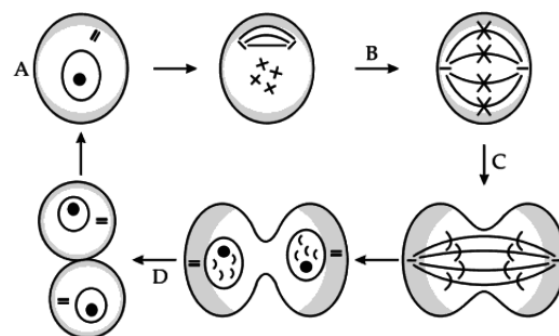
Ans :

COMP 2009

The backbone of a DNA molecule consists of the phosphate groups and the deoxyribose sugars, whereas the base region of the DNA molecule consists of the nitrogenous bases; therefore, the backbone of DNA is made up of phosphate groups and pentose sugars. Adenine is part of the base region of the molecule. DNA does not contain any hexose (six-carbon) sugars.

Thus (d) is correct option.

97. The diagram shows a cell before and during mitosis. At which stage are the chromosomes copied?



Ans :

MAIN 2000

The DNA in the cell is copied in preparation for cell division during interphase or a stage before the start of mitosis. This results in two identical full sets of chromosomes.

Thus (a) is correct option.

ASSERTION AND REASON

98. **Assertion :** G_1 phase is the interval between mitosis and initiation of DNA replication.

Reason : The cell is metabolically inactive during G_1 phase.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both Assertion and Reason are false.

Ans :

SQP 2014

G_1 phase is also known as first growth phase or post mitotic gap phase. It is the phase between end of mitotic phase of previous cell and initiation of S-phase of next mitotic phase. During G_1 phase, the cell is metabolically active and continuously grows. RNA and proteins are synthesized. Organelle duplication such as those of mitochondria and chloroplast also occurs during this phase.

Thus (c) is correct option.

- 99. Assertion :** The M phase represents the phase when the actual cell division occurs.

Reason : Interphase represents the phase between two successive M Phase.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both Assertion and Reason are false.

Ans :

COMP 2019

The M phase represents the phase when the actual cell division occurs. Interphase represents the phase between two successive phases.

Thus (b) is correct option.

- 100. Assertion :** Every chromosome, during metaphase has two chromatids.

Reason : Synthesis of DNA takes places in the S-phase of interphase.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both Assertion and Reason are false.

Ans :

MAIN 2022

In S phase or synthesis phase, chromosomes replicates, DNA content doubles, i.e., 1C to 2C for haploid cells and 2C to 4C for diploid cells. Along with replication of DNA, new chromatin fibres

are formed which remain attached in pairs and the number of chromosomes does not increase. As the chromatin fibres are elongated chromosomes, each chromosome comes to have two chromatin threads which are attached at centromere. During metaphase, every chromosome has two chromatids which separate from each other during anaphase. Thus (a) is correct option.

- 101. Assertion :** During anaphase, centromere of each chromosomes splits and chromatids separate.

Reason : Chromatids move to opposite poles.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both Assertion and Reason are false.

Ans :

SQP 2012

During anaphase the centromeres divide and the chromatids start moving towards the two opposite poles. Spindle fibres attached to the centromeres shorten and pull the chromosomes; the centromeres lead the path while the limbs trail behind. Anaphase ensures that each chromosome receives identical copies of the parent cell's DNA. Thus (b) is correct option.

- 102. Assertion :** Mitosis maintains the genetic similarity of somatic cells.

Reason : Chromosomes do not undergo crossing over.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both Assertion and Reason are false.

Ans :

SQP 2017

Mitosis keeps all the somatic cells of an organism genetically similar, resembling the fertilized egg. Mitosis involves replication and equitable distribution of all the chromosomes so that all the cells of a multicellular organism have the same number and type of chromosomes.

During the formation of gametes by meiosis, paired chromosomes from each parent align so that similar DNA sequences from the paired chromosomes cross over one another. Crossing over results in a shuffling of genetic material and

is an important cause of the genetic variation seen among offspring.

Thus (a) is correct option.

- 103. Assertion :** In animal cells, cytokinesis is marked by the appearance of a furrow in plasma membrane.

Reason : In plant cells, the formation of the new cell wall starts with the formation of simple precursor called cell Plate.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both Assertion and Reason are false.

Ans :

SQP 2004

In an animal cell, cytokinesis is marked by the appearance of a furrow in the plasma membrane which gradually deepens and ultimately joins in the centre dividing the cell cytoplasm into two.

As plants cells are enclosed by a relatively inextensible cell wall they undergo cytokinesis by a different mechanism. New cell plates are formed at the equator, which extend from centre to the periphery (centrifugal) until the cell divides into two daughter cells.

Thus (b) is correct option.

- 104. Assertion:** Genes are specific sequences of nucleotides on a chromosome.

Reason: A nucleotide is made up of nitrogenous base, a phosphate group and a pentose sugar.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both Assertion and Reason are false.

Ans :

MAIN 2016

Genes are made up of DNA and each chromosome contains many genes. Genes are specific sequences of nucleotides on a chromosome. A nucleotide has three components: a nitrogenous base, a pentose sugar (deoxyribose for DNA), and a phosphate group.

Thus (b) is correct option.

- 105. Assertion:** Interphase occupies 75-95% of the total generation time.

Reason: Interphase (I-phase) is the long non-dividing phase.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both Assertion and Reason are false.

Ans :

SQP 2011

The cell cycle is divided into two basic phase:

(i) interphase, (ii) M-phase.

The M phase represents the phase when the actual cell division or mitosis occurs and the interphase represents the phase between two successive M phases. In the 24 hour average duration of cell cycle of human cell, cell division proper lasts for only about an hour. The interphase lasts more than 95% of the duration of cell cycle during which the cell grows and DNA is replicated.

Thus (b) is correct option.

- 106. Assertion :** Karyokinesis occurs in M-phase.

Reason : Cell division stops in M-phase.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both Assertion and Reason are false.

Ans :

MAIN 2007

M-phase represents the phase of actual division. It consists of karyokinesis (the division of nucleus) followed by cytokinesis (the division of cytoplasm). Cell division continues throughout the M-phase and after the M-phase is completed cell division ceases (stops).

Thus (d) is correct option.

ONE MARK QUESTIONS

DIRECTION : Name the following :

- 107.** Acts as bearer of heredity units.

Ans :

MAIN 2002

Chromosomes

108. A pair of corresponding chromosomes of the same shape and size and derived one from each parent.

Ans : SQP 2018, 2017
Homologous Chromosome

109. The number of chromosomes present in a nerve cell of a human being.

Ans : COMP 2018
46

110. A region of plant body where cell division occurs very actively.

Ans : SQP 2002, 1995
Growing points (Apical meristem) such as tips of root and stems.

111. Chromosomes appear thread like.

Ans : COMP 2009
Telophase

112. The type of cell division which occurs in the cells of the reproductive organs.

Ans : MAIN 2010
Meiosis

113. The exchange of chromatid parts between the maternal and the paternal chromatids of a pair of homologous chromosomes during meiosis.

Ans : SQP 2016
Crossing over

114. A nitrogenous base in DNA.

Ans : MAIN 2022
Adenine

115. The two kinds of cell division found in living organisms.

Ans : COMP 2023
Mitosis and Meiosis

116. Name the stage during which nuclear membrane and nucleolus reappear.

Ans : SQP 2018
Telophase

117. The kind of division normally seen at the tip of root and shoot system.

Ans : MAIN 2014

Mitosis

118. The stage when sister chromosomes separate from the paired condition.

Ans : SQP 2005

Meiosis

119. The structure which initiates cell division in animal cells.

Ans : MAIN 2001

Centrosome

120. The point at which the duplicated chromosomes are joined.

Ans : COMP 2010

Centromere

121. The largest phase of a normal cell cycle.

Ans : MAIN 2000

Prophase

122. The shortest phase of mitosis.

Ans : COMP 2008

Anaphase

123. The points of attachment where crossing over occurs.

Ans : MAIN 2003

Chiasmata

124. The type of cell division that occurs in unicellular organisms.

Ans : SQP 2015

Amitosis

125. Division of nucleus.

Ans : MAIN 2009

Karyokinesis

126. Division of cytoplasm.

Ans : COMP 2016

Cytokinesis

127. The stage when chromosomes arrange at the equator.

Ans : SQP 2007

Metaphase

128. A membrane that disappears during late prophase.

Ans : SQP 2023

Nuclear membrane.

129. The structure responsible to transmit characteristics from parent to offspring.

Ans : MAIN 2000

Chromosome

130. The specific part of a chromosome that determines hereditary characteristics.

Ans : COMP 2021

DNA

131. The kind of cell division which occur in pollen grains.

Ans : MAIN 2012

Meiosis

132. What are chromosomes ?

Ans : SQP 2019

The chromosomes are fine thread like structures found in the nucleus of both plant and animal cells.

DIRECTION : Complete the following:

133. The region of the attachment of chromosomes to spindle fibres is at _____.

Ans : COMP 2014

Centromere

134. Exchange of genetic materials between non-sister chromatids is called _____.

Ans : MAIN 2000

crossing over

135. _____ is the pairing of chromosomes during zygotene.

Ans : COMP 2008

Synapsis

136. Replication of DNA occurs in the _____ of interphase.

Ans : MAIN 2020

S-phase

137. Karyokinesis is the division of _____.

Ans :

SQP 2018

nucleus

138. The direct cell division is called as _____.

Ans : COMP 2011

amitosis

139. The chromosome number is _____ in meiosis.

Ans : MAIN 2003

reduced

140. The paired homologous chromosomes of the zygotene stage are called _____.

Ans : SQP 2017

bivalents

141. The process by which cell multiply is called _____.

Ans : SQP 2004

cell division

142. In _____ of interphase, RNA and proteins are synthesised.

Ans : MAIN 2007

G₁ - phase

143. Condensation of chromosome with centromere occurs in _____ of interphase.

Ans : MAIN 2001

S-phase

DIRECTION : State true/false And if the statement is false then write the correct statement :

144. Mitosis is the type of cell division occurring in the cells of injured parts of the body.

Ans : SQP 2010

True

145. Lysosomes is a part of the cell in which chromosomes are present.

Ans : MAIN 2011

False. Nucleus is a part of cell in which chromosomes are present.

146. Centromere is the organelle of the cell that initiates cell division.

Ans : COMP 2011

True

- 147.** The points at which crossing over has taken place between homologous chromosomes are called centromere.

Ans : SQP 2017

False. The points at which crossing over has taken place between homologous chromosomes are called chiasma.

- 148.** Mitosis is called reduction division.

Ans : SQP 2010

False. Meiosis is called reduction division.

- 149.** Four daughter cells are formed as a result of meiosis.

Ans : COMP 2021

True.

- 150.** During anaphase, chromosomes are arranged at the equator.

Ans : MAIN 2014

False. During anaphase, chromosomes are arranged at the poles.

- 151.** During telophase, the nuclear membrane disappears.

Ans : COMP 2002

False. During telophase, the nuclear membrane reappears.

- 152.** The number of pairs of autosomes in man is 22.

Ans : MAIN 2000

True.

- 153.** Lysosome is a part of the cell in which chromosomes are present.

Ans : SQP 2015

False. Nucleus is a part of the cell in which chromosomes are present.

- 154.** The resting stage in mitosis is called interphase.

Ans : MAIN 2023

True.

- 155.** Duplicated chromosomes remain attached at a point termed centrosome.

Ans : COMP 2020

False. Duplicated chromosomes remain attached at a point termed centromeres.

- 156.** Choose the correct answer :

Duplicated chromosomes are joined at a point termed
(centrosome, centromere, centriole, chromatid).

Ans : MAIN 2002

Centromere

DIRECTION : Fill in the blanks with suitable words:

- 157.** The chromosome number in our skin cell is _____.

Ans : MAIN 2019

46

- 158.** The spindle fibres are made-up of _____.

Ans : COMP 2015

Microtubules

- 159.** The process by which gametes are formed is called _____.

Ans : COMP 2006

Gametogenesis (Meiosis)

- 160.** The direct cell division is called as _____.

Ans : MAIN 2009

Amitosis

- 161.** In meiosis, the parent cell is diploid whereas the daughter cell is _____.

Ans : COMP 2018

Haploid

- 162.** By the end of prophase, chromosomes are seen as thick rods each having two rods called _____ chromatids.

Ans : SQP 2001

Sister

- 163.** The chromosomes which are exactly similar and bear same genes at same loci are called _____ chromosomes.

Ans : MAIN 2007

Homologous

- 164.** The chromosome number is _____ in meiosis.

Ans : COMP 2021

Halved

165. The process by which cell multiplies is called_____.

Ans : SQP 2004

Cell division

166. The chromosomes move to the opposite poles in_____stage.

Ans : COMP 2017

Anaphase

167. Meiosis I is also known as_____division.

Ans : MAIN 2001

Reductional

DIRECTION : Choose the ODD one out from the following terms given and name the CATEGORY to which the others belong:

Example : Nose, Tongue, Arm, Eye

Answer : Odd Term - Arm, Category - Sense organs

168. Centrosome, Cell wall, Cell membrane, Large vacuoles

Ans :

Odd term - Centrosome, Category - Parts of plant cell

169. Phosphate, RNA, Sugar, Nitrogenous base

Ans : MAIN 2018

RNA : Rest are components of DNA

DIRECTION : Give appropriate biological or technical terms for the following :

170. The suppressed alleles of a gene.

Ans : COMP 2017

Recessive

171. The complex consisting of a DNA strand and a core of histones.

Ans : SQP 2018

Nucleosome

172. Expand the following biological abbreviations DNA.

Ans : SQP 2019

Deoxyribonucleic acid

173. The exchange of chromatid parts between the maternal and the paternal chromatids of a pair of homologous chromosomes during meiosis.

Ans : MAIN 2016

Crossing over

174. The kind of division that takes place in the reproductive tissues.

Ans : COMP 2010

Anaphase

175. The repeating components of each DNA strand lengthwise.

Ans : SQP 2016

Deoxyribonucleotide

176. An alteration in the genetic material that can be inherited.

Ans : COMP 2016

Mutation

DIRECTION : Distinguish between the following on the basis of what is given in the brackets:

177. Karyokinesis and Cytokinesis. (explain the term)

Ans : MAIN 2010

Karyokinesis is the division of the nucleus into two daughter nuclei. There are mainly four steps involved in karyokinesis and they are prophase, metaphase, anaphase and telophase.

Cytokinesis is the division of the cytoplasm to form two daughter cells. It varies in plant and animal cells. Cytokinesis follows the karyokinesis.

178. Mitosis and Meiosis. (number of daughter cells formed)

Ans : COMP 2004

Mitosis – Two daughter cells are formed.

Meiosis – Four daughter cells are formed.

DIRECTION : Correct the following statements by changing the underlined words :

179. Nitrogen bonds are present between the complementary nitrogenous bases of DNA.

Ans : SQP 2018

Hydrogen

DIRECTION : Identify the odd one from a set of four terms and name the category to which the other three belong.

180. Thymine, Cytosine, Adenine, Pepsin.

Ans :

COMP 2016

Odd one: Pepsin

Category: Nitrogen base bases of DNA (thymine, cytosine, adenine).

181. Phosphate, RNA, Sugar, Nitrogenous base

Ans :

MAIN 2017

Odd one: RNA

Category: Components of DNA

DIRECTION : Rewrite the following terms into logical sequence:

182. Karyokinesis, S-phase, cytokinesis, G-1 phase, G-2 phase.

Ans :

MAIN 2012

G-1 phase, S-phase, G-2 phase, karyokinesis, cytokinesis.

183. Interphase, Anaphase, Prophase, Telophase, Metaphase

Ans :

SQP 2018

Interphase → Prophase → Metaphase → Anaphase → Telophase.

DIRECTION : Given below are groups of terms. In each group the first pair indicates the relationship between the two terms. Rewrite and complete the second pair on a similar basis.

Example: Oxygen : Inspiration :: Carbon dioxide: Expiration

184. Cytoplasm : Cytokinesis :: Nucleus : _____

Ans :

Cytoplasm : Cytokinesis :: Nucleus : Karyokinesis.

185. Adenine : Thymine :: Cytosine : _____

Ans :

COMP 2017

Adenine : Thymine :: Cytosine : Guanine

186. Write the terms in correct order so as to be in logical sequence:

Metaphase; telophase; prophase; anaphase.

Ans :

SQP 2004

Prophase, metaphase, anaphase, telophase.

DIRECTION : Match the following:

187. Column 'B' is a list of terms related to ideas in column 'A'. Match the term in column 'B' with the suitable idea given in column 'A'.

	Column A		Column B
(i)	Chromosomes become arranged in a horizontal plane at the equator.	(a)	Anaphase
(ii)	Daughter chromosomes move to opposite poles of the spindle.	(b)	Prophase
(iii)	Chromosomes become visible as fine, long threads.	(c)	Telophase
(iv)	Chromosomes lose their distinctiveness and generally become transformed into chromatin network.	(d)	Metaphase

Ans :

SQP 2017

	Column A		Column B
(i)	Chromosomes become arranged in a horizontal plane at the equator.	(d)	Metaphase
(ii)	Daughter chromosomes move to opposite poles of the spindle.	(a)	Anaphase
(iii)	Chromosomes become visible as fine, long threads.	(b)	Prophase
(iv)	Chromosomes lose their distinctiveness and gradually become transformed into chromatin network.	(c)	Telophase

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DIRECTION : State the differences between the following pairs:

188. Mitosis and Meiosis

Ans :

MAIN 2020

The differences between Mitosis and Meiosis are as follows :

	Mitosis	Meiosis
(a)	It is an equational division.	It is a reductional division.
(b)	Two diploid daughter cells are formed.	Four haploid daughter cells are formed.
(c)	Only one division occurs.	Two divisions occur.
(d)	It occurs in somatic cells.	It occurs in reproductive cells.

189. Centrosome and Centromere

Ans :

SQP 2023

The differences between Centrosome and Centromere are as follows :

	Centrosome	Centromere
(a)	It is an organelle of the animal cell.	It is a point at which the duplicate chromosomes are joined.
(b)	It contains two centrioles which move towards the opposite poles and form spindle fibres during cell division.	It provides site for attachment of spindle fibres during cell division.

190. Cytokinesis and Karyokinesis

Ans :

COMP 2008

The differences between Cytokinesis and Karyokinesis are as follows :

	Cytokinesis	Karyokinesis
(a)	It is the division of cytoplasm.	It is the division of nucleus.
(b)	It takes place after Karyokinesis.	It is the first division.

191. Cytokinesis in plant and animal cell

Ans :

SQP 2002

The differences between Cytokinesis in plant and animal cell are as follows :

	Cytokinesis in plant cell	Cytokinesis in animal cell
(a)	It starts with a cell plate formation.	Cell plate formation is absent. A constriction furrow forms in the middle of cell membrane.
(b)	It is centrifugal.	It is centripetal.

192. Mitosis in animal and plant cell

Ans :

MAIN 2008

The differences between Mitosis in animal and plant cell are as follows :

	Mitosis in Animal Cell	Mitosis in Plant Cell
(a)	Centrosome is present.	Centrosome is absent.
(b)	Asters and spindle formation occurs.	Asters are not formed.
(c)	In telophase, cytoplasm constrict.	In telophase, a cell plate is laid in the cytoplasm at the equatorial plane.

193. Asexual and Sexual Reproduction

Ans :

SQP 2001

The differences between Asexual and Sexual Reproduction are as follows :

	Asexual Reproduction	Sexual Reproduction
(a)	It is a type of reproduction without gamete formation.	Gametes are produced.
(b)	Variations are not produced.	Variations are produced.

194. S-phase and G₂-phase

Ans :

COMP 2009

The differences between S-phase and G₂-phase are as follows :

	S-phase	G ₂ -phase
(a)	Replication of DNA occurs in this phase.	rRNA and mRNA are synthesised in this phase.
(b)	At this stage, the cell contains 2n of DNA.	At this stage, the cell contains 4n of DNA.

DIRECTION : Answer the following :

- 195.** What are the two divisions that follow during cell division ?

Ans : MAIN 2000
Karyokinesis and cytokinesis.

- 196.** How many meiotic divisions are necessary to produce 100 pollen grains ?

Ans : COMP 2022
25 meiotic divisions.

- 197.** What is synapsis ?

Ans :
Pairing of homologous chromosomes during zygotene stage of meiosis is called synapsis.

- 198.** Name two animals which have nineteen pairs of chromosomes.

Ans : COMP 2004
Lion ; Tiger.

- 199.** Write the names of four nitrogenous bases in a DNA molecule.

Ans : MAIN 2013
The four nitrogenous bases in a DNA molecule are :
1. Adenine
2. Guanine
3. Cytosine
4. Thymine

- 200.** Give the specific function of Centrosome

Ans : SQP 2009
Centrosome initiates and regulates cell division in animal cells by forming spindle fibres with the help of asters.

- 201.** What is a gene ?

Ans : MAIN 2000
A gene is a unit of heredity composed of DNA.

- 202.** What are the two forms of genes known as ?

Ans : COMP 2017
The two forms of genes are called alleles.

- 203.** Where does Meiosis occur in our body ?

Ans : SQP 2021
Meiosis occurs in the reproductive organs (testis and ovary) of our body.

- 204.** What happens during metaphase of mitosis?

Ans : SQP 2011
During metaphase of mitosis, chromosomes are arranged at the equator.

- 205.** What is synapsis?

Ans : MAIN 2018
Synapsis is the pairing of homologous chromosomes. It occurs in zygotene stage of meiosis I.

TWO MARKS QUESTIONS

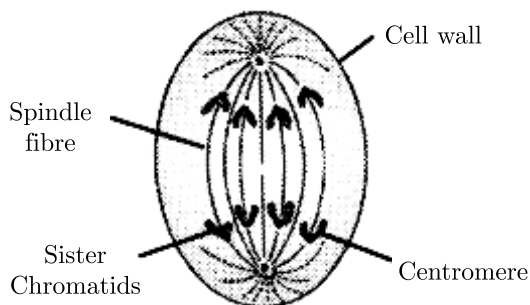
- 206.** During Mitosis what is the position of chromatids in:

- (a) Metaphase
(b) Anaphase

Ans : SQP 2025
(a) In the equatorial plane
(b) Sister chromatids separate and move towards the opposite poles.

- 207.** Draw a well labelled diagram to show the anaphase stage of mitosis in a plant cell having four chromosomes.

Ans : COMP 2005



208. How is variation produced in a species ?

Ans :

MAIN 2001

During meiosis, exchange of genetic material between non-sister chromatids occur resulting in new combinations. These combinations give rise to variation resulting in the evolution of species.

209. Why is the first division of meiosis called as reductional division ?

Ans :

SQP 2017

The first division of meiosis is called as reductional division because in this division the chromosome number is reduced to half.

210. Why do gametes have a haploid number of chromosomes ?

Ans :

COMP 2019

Gametes have a haploid number of chromosomes in order to maintain the $2n$ chromosome of diploid zygote, when they fuse together to form the zygote.

211. State how does meiosis maintain the chromosome number in a species?

Ans :

COMP 2023

The gametes are formed by meiosis during which the number of chromosomes are reduced to half, *i.e.* gametes contain haploid number of chromosomes. The male and female gametes fuse to form a zygote. In this way meiosis maintains the chromosome number in a species.

212. Name the type of cell division that occurs during :

- (i) Growth of shoot
- (ii) Formation of pollen grains
- (iii) Repair of worn out tissues

Ans :

SQP 2017

- (i) Mitosis
- (ii) Meiosis
- (iii) Mitosis

213. What is Interphase ? Mention Three significant changes that occur in a cell during Interphase.

Ans :

MAIN 2010

In between two divisions, when a cell is resting or non-dividing, the phase is called interphase. The three significant changes that occur in cell during interphase are :

1. Chromatin material duplicates.

2. DNA is synthesized.
3. Cell increases in size.

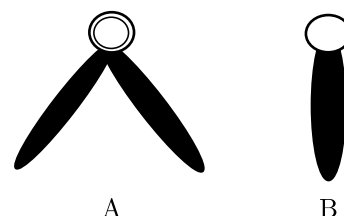
214. What is a sat chromosome ?

Ans :

SQP 2002

Sometimes the chromosomes bear round, elongated or knob like appendages known as satellites. The satellite remains connected to the rest of the chromosomes with satellites are called sat chromosomes.

215. The figure shows two types of chromosomes. Identify them and give reason for your choice.



Ans :

COMP 2009

A – Metacentric : The centromere is present in the centre and two arms of the chromatids are equal.

B – Telocentric : The centromere is present at one end of the chromosome.

216. What is the significance of mitosis?

Ans :

SQP 2015

It helps in the growth, repair and development of the body. It is a type of reproduction in protozoans.

217. State the importance of meiosis.

Ans :

MAIN 2003

The importance of meiosis are as follows :

- (i) It brings about variations in a species.
- (ii) It maintains the chromosome number of a species.
- (iii) It helps in evolution of species.

218. Name the cell division that takes place during gametogenesis. What is its significance ?

Ans :

SQP 2020

Meiosis occurs during gametogenesis.

Its significance is that it helps to restore the number of chromosomes of the species.

219. Why is variation seen in progeny ?

Ans :

COMP 2013

The exchange of the chromosome material during crossing over provides innumerable recombinations because of which the off-springs of the same parents however similar are different from each other in some respects. The variations are one of the important cause of evolution.

220. What is crossing over?

Ans : SQP 2010

It is the process of exchange of genetic material between the non-sister chromatids of homologous chromosomes. It occurs during pachytene stage of meiosis.

221. How does meiosis maintain chromosome number?

Ans : SQP 2005

During meiosis, chromosome number in the cell is reduced to half. The gametes contain haploid number of chromosomes. During fertilisation, the male and the female gametes fuse and form a diploid cell.

222. Meiosis is referred to as reduction division. Why?

Ans : COMP 2000

Meiosis is called reduction division because chromosome number reduces to half in daughter cells.

223. Why is meiosis essential in sexually reproducing organisms?

Ans : MAIN 2008

Meiosis helps to maintain a definite number of chromosomes in a species; crossing over which occurs during meiosis produces variations.

224. What is a SAT chromosome?

Ans : COMP 2012

Sometimes a few chromosomes have a secondary constriction. The part of the chromosome beyond the secondary constriction is called satellite. Such chromosomes are called SAT chromosomes.

225. How does cytokinesis occur in an animal cell?

Ans : SQP 2022

In an animal cell, a cleavage/furrow appears during telophase in the plasma membrane. This furrow deepens and meets in the middle to form two daughter cells.

226. How does cytokinesis occur in a plant cell?

Ans :

MAIN 2019

In a plant cell, a cell plate is formed between the two daughter nuclei. It grows outwards and ultimately touches the cell wall. It forms the middle lamella.

227. What are the various ways in which pairing occurs during zygotene?

Ans : SQP 2014

Pairing may start from both the ends and move towards the centre, it may start from the centre and move towards either end of the nucleus.

228. What happens during prophase of mitosis?

Ans : COMP 2010

During prophase, chromatin material starts condensing to form chromosomes. Each chromosome contains two chromatids joined at the centromere. Nuclear membrane and nucleolus disappears. Spindle fibres appear between the two centrioles.

229. Identify and name the following processes/terms from the statements given below:

- Chromosomes appear thread like.
- A pair of chromosomes carrying dissimilar alleles for a particular character.

Ans : COMP 2018

- Chromatin fibres.
- Heterozygous chromosomes.

230. Give reason: Gametes have a haploid number of chromosomes.

Ans : SQP 2020

Gametes are formed after meiosis. During meiosis, reduction of the number of chromosomes occurs. So, during fertilisation the original number of chromosomes are retained.

231. State the functions of chiasmata.

Ans : MAIN 2004

The functions of chiasmata are as follows :

- Crossing over takes place at the chiasmata during meiosis.
- To hold the homologous chromosomes together prior to segregation.

232. What are the changes that occur during S-phase?

Ans : SQP 2012

S-phase: During this phase, replication of DNA

takes place. Each chromosome contains two sister chromatids and are attached to a common centromere.

- 233.** Briefly explain the types of chromosomes according to the positions of centromere.

Ans :

COMP 2017

Based on the position of centromere, the chromosomes are of four types:

1. Telocentric – It has a terminal centromere.
2. Acrocentric – Centromere is near to one end.
3. Submetacentric – Centromere is slightly away from the centre.
4. Metacentric – Centromere is in the middle.

- 234.** What is DNA fingerprinting ?

Ans :

SQP 2013

There are regions in between genes which are non-functional. These areas/regions show tremendous variation from individual to individual and are peculiar from person to person. This technique is commonly known as DNA fingerprinting.

or

It is a technique used to identify and analyse the variations in various individuals at the level of DNA. It is based on variability and polymorphism in DNA sequences.

Now a days this technique is used to a great extent in forensic science.

- 235.** The term 'stem cells' are often heard these days. Explain briefly of what it means.

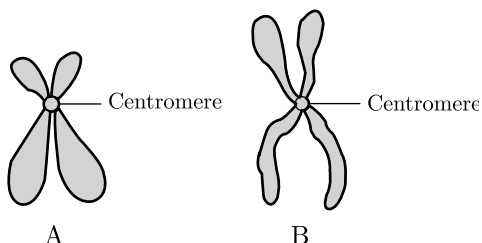
Ans :

COMP 2017

Stem cells are biological cells that has the ability to differentiate into specialized cell types (mainly into different tissues and organs).

They are generally found in multicellular organisms.

- 236.** The figure A and B show two types of chromosomes, identify them and write the difference.



Ans :

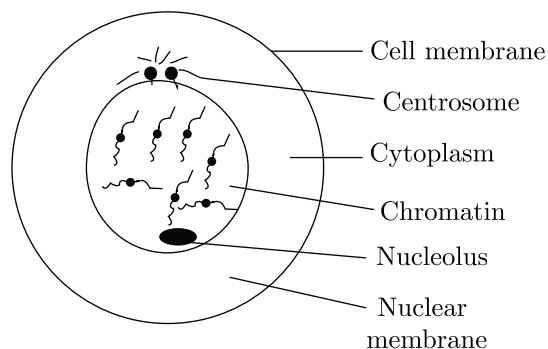
COMP 2006

Figure A, is acrocentric; Figure B, is metacentric. In acrocentric chromosome, the centromere is near to terminal region while in metacentric, the centromere is in the centre of the chromosome.

THREE MARKS QUESTIONS

- 237.** The given figure shows a cell. Study the figure and then answer the questions that follow :

- (i) Identify the stage of cell cycle depicted by the cell.
- (ii) Write any two characteristics of this phase.
- (iii) What are the main events which take place when the cell goes into the next stage ?



Ans :

MAIN 2009

- (i) Inter-phase
- (ii) Inter-phase of a cell is characterized by :
 1. Growth in cell size.
 2. Duplication of chromatin material and gets thinned and coiled up.
- (iii) As the cell enters the next stage (Prophase) the following events take place :
 1. Centrioles become free and begin to move towards the opposite poles.
 2. Astral rays are developed and chromosomes are seen.
 3. Nuclear membrane and nucleolus starts disappearing.

- 238.** Try to guess the time period (in terms of days or years) of how long the following cells last or are replaced in human body.

- (a) Liver cells
- (b) Bone cells
- (c) Epithelial cells of the gut
- (d) Skin cells
- (e) RBC
- (f) Eye, nerve and muscle cells

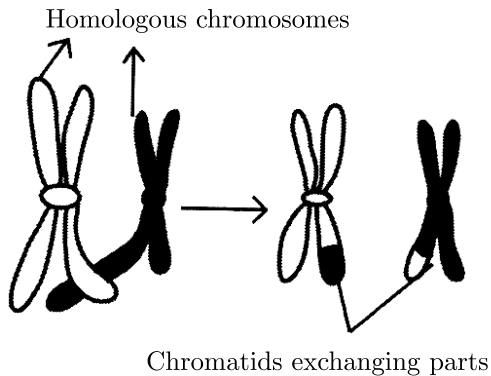
NODIA

Ans :

SQP 2007

- (a) 300-500 days
- (b) Every 10 years (approximately)
- (c) 5 days
- (d) Every 14-15 days
- (e) 120 days (approximately)
- (f) Life time

239. The given figure represents a certain phenomenon that occurs during meiosis:



- (i) Name of the phenomenon.
- (ii) Define the phenomenon.
- (iii) State the difference between chromosomes and chromatids.

Ans :

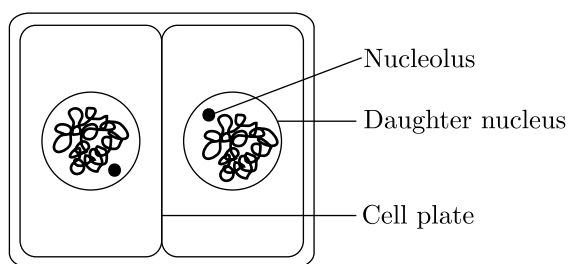
MAIN 2008

- (i) Crossing over.
- (ii) It is the exchange of genetic material between the non-sister chromatids of homologous chromosomes.
- (iii) Chromosomes are the carriers of heredity. Chromatids are the two identical strands of a duplicated chromosome.

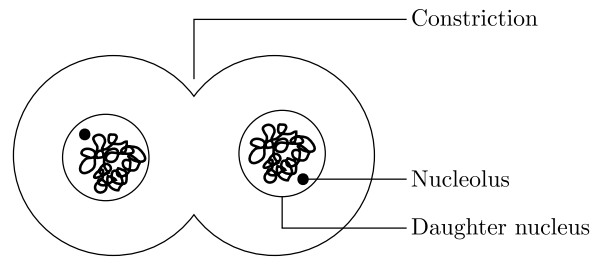
240. With the help of neat sketches show how cytokinesis differs in a plant cell and in an animal cell.

Ans :

COMP 2013

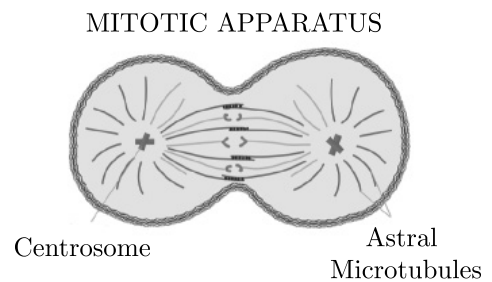


Cytokinesis in plant cell



Cytokinesis in animal cell

241. Identify the stages of meiosis and label the parts 1 to 5.



Ans :

MAIN 2008

Anaphase-II

- 1. Centriole;
- 2. Aster ray;
- 3. Spindle fibre;
- 4. Chromatid,
- 5. Centromere

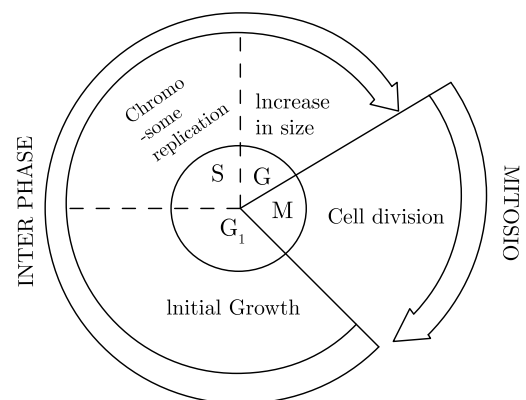
242. Draw the diagram of the following :

- (i) A cell cycle
- (ii) Telophase stage of mitosis in plant cell.

Ans :

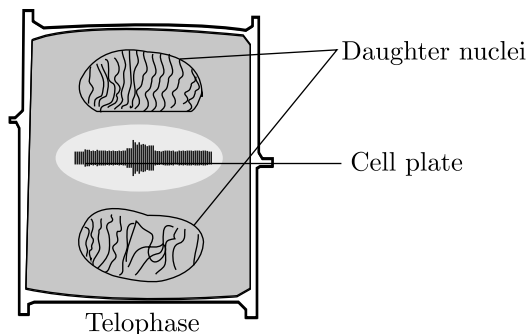
SQP 2017

(i)



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(ii)

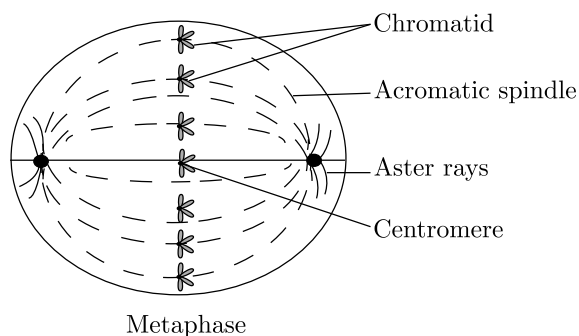


243. Draw a diagram of the nucleus of a cell, having chromosome number 6, as it would appear in the metaphase stage of mitosis and label the following parts:

- (a) Aster rays, (b) Acromatic spindle, (c) Chromatid, (d) Centromere.

Ans :

MAIN 2020



shown in the diagram. Draw a neat labelled diagram of the stage mentioned.

- (v) Which is the cell division that results in half the number of chromosomes in daughter cells?

Ans :

COMP 2017

- (i) Telophase.

The reasons are:

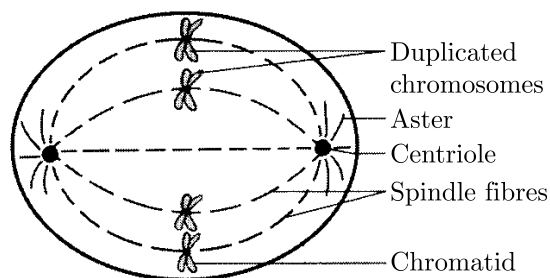
1. Two sets of daughter chromosomes are seen on the opposite poles of the cell.
2. Reappearing of nuclear membrane and nucleoli.
3. Formation of the chromatin fibres and deepening of cleavage furrow.

- (ii) 1. chromosomes

2. Nuclear membrane.

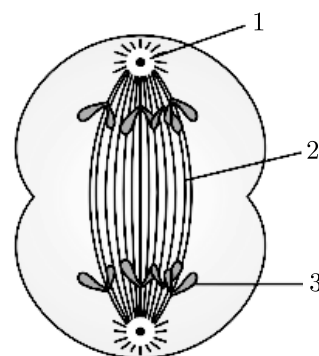
- (iii) Karyokinesis.

- (iv) Anaphase.



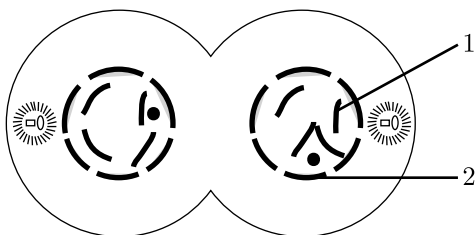
- (v) Meiosis.

245. The diagram below represents a stage during cell division. Study the same and then answer the questions that follow :



FIVE MARKS QUESTIONS

244. Study the diagram given below which represents a stage during the mitotic cell division and answer the questions that follow:



- Identify the stage giving suitable reasons.
- Name the parts numbered 1 and 2.
- What is the technical term for the division of nucleus?
- Mention the stage that comes before the stage

- (i) Name the parts labelled 1, 2 and 3

- (ii) Identify the above stage and give a reason to support your answer.

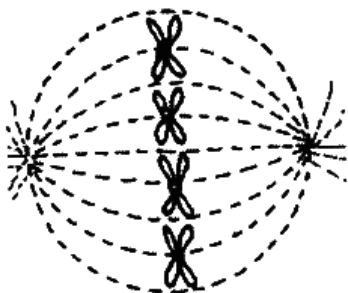
- (iii) Mention where in the body this type of cell division OMITS.

- (iv) Name the stage prior to this stage and draw a diagram to represents the same.

Ans :

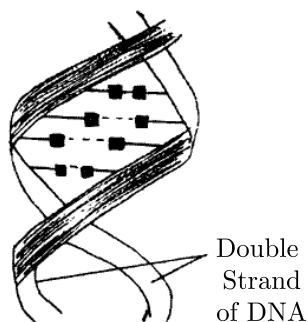
SQP 2011

- (i) 1. Aster with astral rays (Centriole)
2. Spindle fibre and
3. Daughter chromosome.
- (ii) Late Anaphase, as splitting of chromosome takes place and daughter chromosome proceeds towards the poles.
- (iii) Somatic cells
- (iv) Metaphase



246. There is a diagram of a double helical structure of DNA:

- (i) Name the four nitrogenous bases that form a DNA molecule.
- (ii) Give the full form of DNA.
- (iii) Name the unit of heredity.
- (iv) Mention two points of difference between Mitosis and Meiosis.



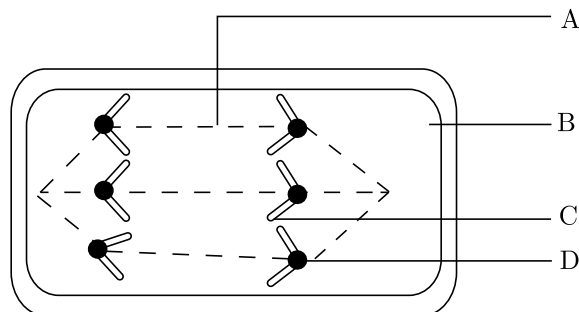
Ans :

COMP 2010

- (i) Adenine, guanine, thymine and cytosine.
- (ii) Deoxyribonucleic acid.
- (iii) Genes.
- (iv)

	Mitosis		Meiosis
(a)	It occurs in the somatic cells.	(a)	It occurs in the reproductive cells.
(b)	Two daughter cells are formed.	(b)	Four daughter cells are formed

247. The diagram given below represents a certain stage of mitosis:



- (i) Identify the stage of cell division.
- (ii) Name the parts labelled A and B.
- (iii) What is the unique feature observed in this stage?
- (iv) How many daughter cells are formed from this type of cell division?

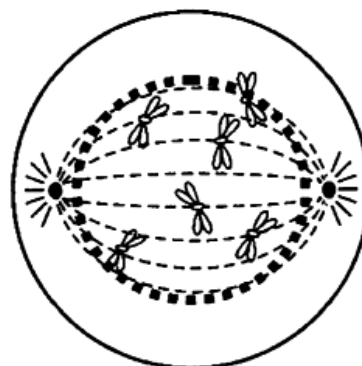
Ans :

COMP 2015

- (i) The phase is Anaphase.
- (ii) A – Spindle fibre
B – Centromere/kinetochore
- (iii) The unique feature is that the spindle fibres are contracting and sister chromatids/daughter chromosomes are moving towards the opposite poles of the cell.
- (iv) Two daughter cells are formed from this type of cell division.

248. The given diagram shows a stage during mitotic division in an animal cell :

- (i) Identify the stage. Give a reason to support your answer.



- (ii) Draw a neat labelled diagram of the cell as it would appear in the next stage. Name the stage.
- (iii) In what two ways is mitotic division in an animal cell different from the mitotic division in a plant cell ?

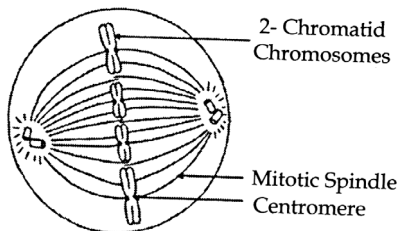
(iv) Name the type of cell division that occurs during:

- A. Growth of a shoot
- B. Formation of pollen grains.

Ans :

SQP 2016

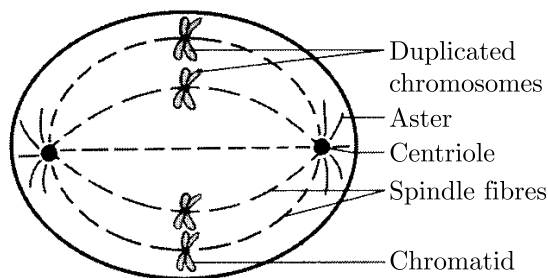
- (i) Prophase-Nuclear membrane and nucleolus disappear, chromatin resolve into chromosomes.
- (ii) Next stage is as shown below :



- (iii) In animal cell, amphiastral spindle is formed whereas it is anastral spindle in the plant cells. Secondly, in animal cells, cytokinesis takes place centripetally by constriction whereas in plant cells, it is centrifugally by the formation of cell plate.

(iv) A-Mitosis and B-Meiosis.

249. Given diagram representing a stage during mitotic cell division in an animal cell :



- (i) Identify the above stage. Give a reason to support your answer.
- (ii) Name the parts labelled 1, 2, 3 and 4.
- (iii) What is the function of part 3?
- (iv) Name the stage that comes just after the stage shown in the diagram. Draw a well labelled diagram of this stage.

Ans :

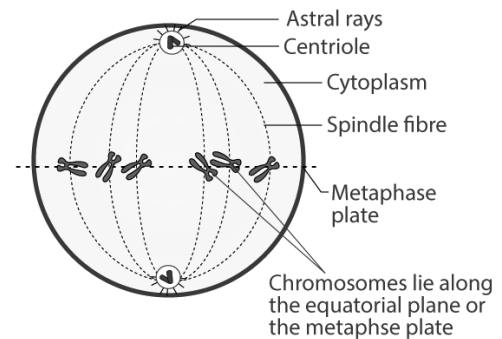
MAIN 2010

- (i) Late prophase. Reason : Centrosome splits into two, occupying each pole, nuclear membrane degenerating and chromosomes move towards the equator of the cell, spindle fibres appear between two asters (centrioles).
- (ii) 1. Astral rays 2. Chromatid 3. Centromere 4.

Spindle fibres.

- (iii) The division of centromere helps in the separation of two sister chromatids of each chromosome, which are drawn apart towards opposite poles.

(iv) Metaphase



250. Given below is diagram representing a stage during mitotic cell division. Study it carefully and answer the questions that follow:

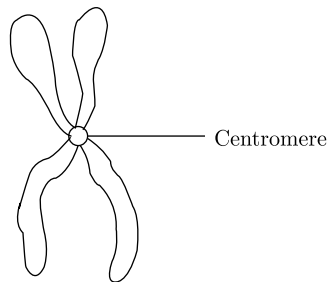


- (i) Is it a plant cell or an animal cell? Give a reason to support your answer.
- (ii) Identify the stage shown.
- (iii) Name the stage that follows the one shown here. How is that stage identified?
- (iv) How will you differentiate between mitosis and meiosis on the basis of the chromosome number in the daughter cells?
- (v) Draw a duplicated chromosome and label its parts.

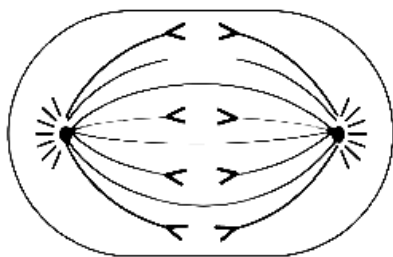
Ans :

COMP 2014

- (i) Plant cell:
 1. It has cell wall.
 2. Centrioles not present.
- (ii) Prophase.
- (iii) Metaphase. Chromosomes arrange themselves upon the equator of a spindle.
- (iv) Mitosis – 46 chromosomes
Meiosis – 23 chromosomes
- (v)



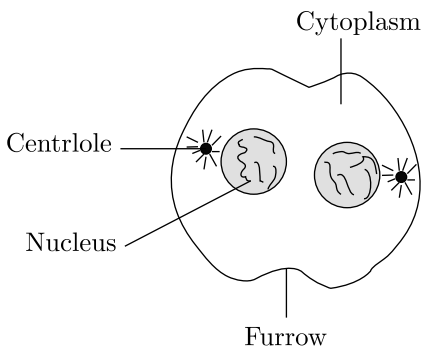
251. Given below is a diagram representing a stage during the mitotic cell division. Study the diagram and answer the following questions :



- (i) Identify the stage by giving a suitable reason.
- (ii) Is it a plant or an animal cell ? Give a reason to support your answer.
- (iii) Draw a neat, labelled diagram of the stage which follows the one shown in the diagram.
- (iv) How many chromosomes will each daughter cell have after the completion of the above division ?
- (v) Name the four nitrogenous bases.

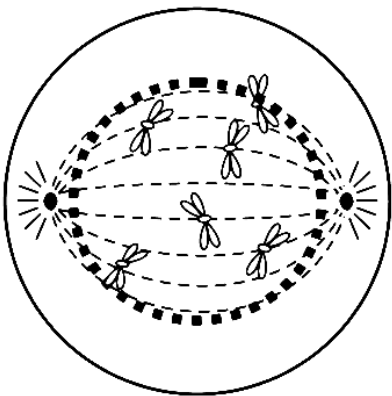
Ans : SQP 2019

- (i) Anaphase : Two sister chromatids move towards opposite poles.
- (ii) Animal cell : No cell wall; presence of centrioles at opposite poles.
- (iii)



- (iv) Four
- (v) Adenine, Guanine, Cytosine, Thymine

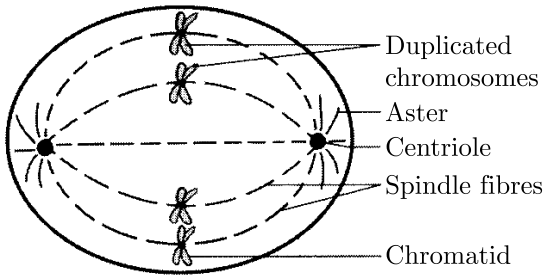
252. The given diagram shows a stage during mitotic division in an animal cell:
- (i) Identify the stage. Give a reason to support your answer.
 - (ii) Draw a neat labelled diagram of the cell as it would appear in the next stage. Name the stage.
 - (iii) In what two ways is mitotic division in an animal cell different from the mitotic division in a plant cell?
 - (iv) Name the type of cell division that occurs during:



- A. Growth of a shoot
- B. Formation of pollen grains.

Ans : COMP 2016

- (i) Prophase Reason – Nuclear membrane is disappearing.
- (ii)



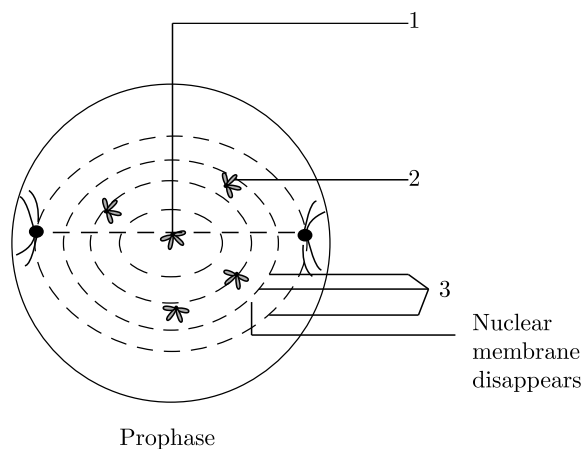
(iii)

	Mitosis in plants		Mitosis in animals
(a)	Asters are not formed due to lack of centrioles.	(a)	Asters are formed.
(b)	Formation of cell plate in telophase.	(b)	A constriction forms in the cytoplasm in telophase.

- (iv) A. Mitosis, B. Meiosis.

253. Given is a diagram representing a stage during mitotic cell division in an animal cell.

- Identify the stage. Give a reason to support your answer.
- Name the cell organelle that forms the aster.
- Name the parts labelled 1, 2 and 3.
- Name the stage that follows this stage of mitosis. How can this stage be identified?



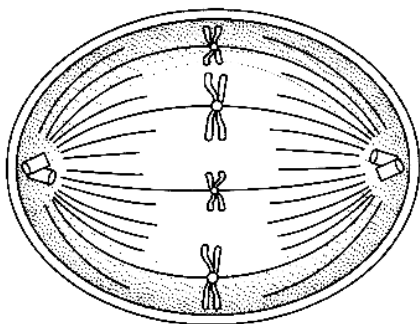
Ans :

MAIN 2010

- Late prophase. The reason is that nuclear membrane disappears.
- Centrosome (centrioles).
1. Centromere, 2. Chromosome, 3. Spindle fibres
- Metaphase. The chromosomes arrange themselves on the equatorial or metaphase plane.

254. The diagram given below represents a stage during cell division.

Study the same and answer the questions that follow :



- Identify whether it is a plant cell or an animal cell. Give a reason in support of your answer.
- Name the stage depicted in the diagram. What is the unique feature observed in this stage?

(iii) Name the type of cell division that occurs during:

- Replacement of old leaves by new ones.
- Formation of gametes.

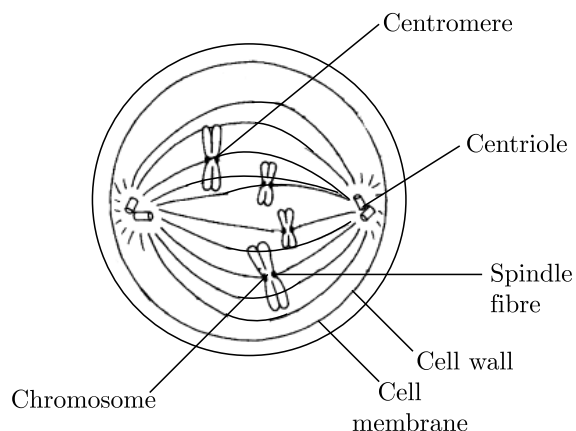
(iv) What is the stage that comes before the stage shown in the diagram ?

(v) Draw a neat, labelled diagram of the stage mentioned in above keeping the chromosome number constant.

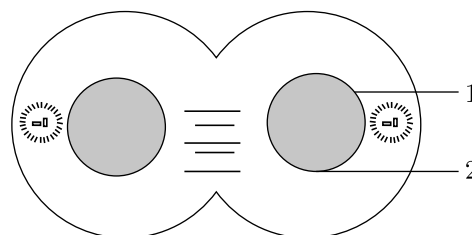
Ans :

SQP 2012

- Animal cell : Centriole is present. [It can be a plant cell also as it is double layered (cell wall present) and astral rays are absent].
- Metaphase : Unique feature is chromosomes are arranged at the equatorial plate (metaphasic) plate.
1. Mitosis
2. Meiosis
- Prophase
-



255. Study the diagram given below which represents a stage during the mitotic cell division and answer the questions that follow :



- Identify the stage giving suitable reasons.
- Name the parts numbered 1 and 2.
- What is the technical term for the division of nucleus?
- Mention the stage that comes before the stage shown in the diagram. Draw a neat labelled

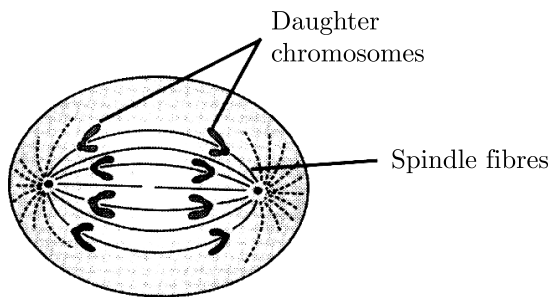
diagram of the stage mentioned.

- (v) Which is the cell division that results in half the number of chromosomes in daughter cells?

Ans :

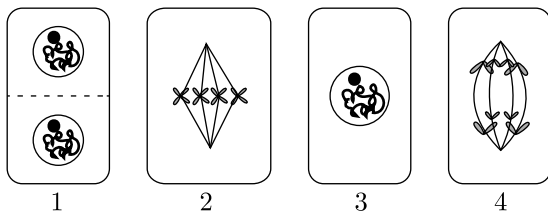
SQP 2017

- (i) The stage is Telophase. The reason is the nucleus and nucleolus reappears and spindle fibres disappear.
- (ii) 1. Centromere
2. Nuclear membrane/Nucleus
- (iii) Karyokinesis
- (iv) Anaphase



- (v) Meiosis

256. The diagram represents the four stages of cell division. Study the diagram carefully and then answer the following questions :

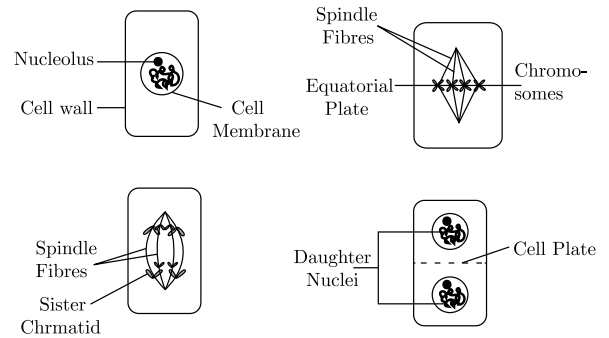


- (i) What are the four stages of cell division ?
- (ii) Label the various parts indicated after rearranging the four stages in sequential order.
- (iii) In which stage the chromosomes undergo maximum condensation and arrange themselves in the equatorial plate ?
- (iv) Name the structure by which the chromosomes get attached to the spindle fibres.
- (v) Define the type of cell division that is represented in the above diagram.

Ans :

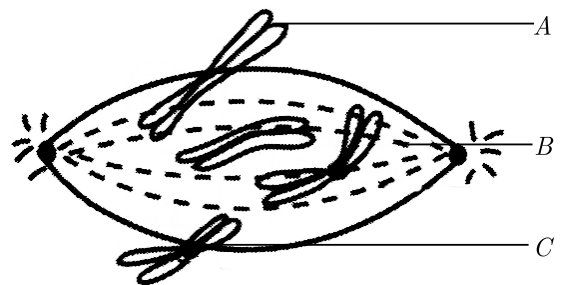
COMP 2009

- (i) 1. Prophase
2. Metaphase
3. Anaphase
4. Telophase.
- (ii)



- (iii) Metaphase
- (iv) Centromere/kinetochore
- (v) Mitosis : Mitosis is a type of cell division in which each chromosome of a parent cell splits up longitudinally into two identical halves, each half going to each of the daughter cell.

257. The figure shows a certain stage in cell division in a cell with 4 chromosomes.



- (i) Name the parts labelled A and B.
- (ii) What is C ? Give its function.
- (iii) Name the type of division with a logic reason.
- (iv) Name the stage before and the stage after the stage shown in the diagram.

Ans :

MAIN 2013

- (i) A is chromatid
B is centromere
- (ii) C is spindle to which chromosomes attach. The spindle fibres pull the chromatids apart.
- (iii) Mitosis.
The chromosomes line up on the spindle singly. If it were meiosis the chromosomes would be in homologous pair.
- (iv) The stage before is interphase and the stage after is metaphase.

258. Give one point of difference on the basis of what is given in the brackets:

- (i) Metacentric and Telocentric chromosomes
-(Position of centromere)
- (ii) Mitosis and Meiosis
-(Number of daughter cells formed)

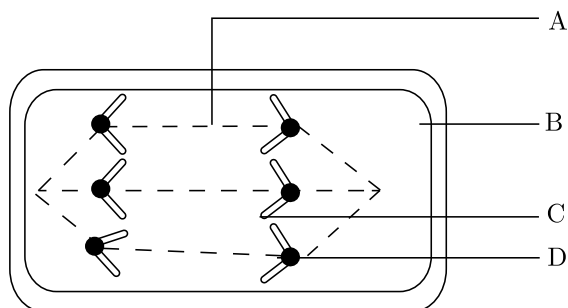
- (iii) Maternal and Paternal chromosomes
–(Source)
- (iv) Chiasmata and Crossing over –(Function)
- (v) Mitosis in animal cell and Mitosis in plant cell
–(Telophase stage)

Ans :

MAIN 2002

(i)	Metacentric chromosomes Centromere is present in the centre of chromosome.	Telocentric chromosomes Centromere is present at one end of chromosome.
(ii)	Mitosis Two daughter cells from one single cell.	Meiosis Four daughter cells from a single cell.
(iii)	Maternal chromosomes. These chromosomes are from mother's side.	Paternal chromosomes These chromosomes are from father's side.
(iv)	Chiasmata It is the point of attachment of non-sister chromatids of homologous chromosomes where crossing over takes place.	Crossing over It is the exchange of genetic material between non-sister chromatids of homologous chromosomes.
(v)	Mitosis in animal cell In telophase stage, cytoplasm constricts.	Mitosis in plant cell In telophase stage, a cell plate is laid in the cytoplasm at the equatorial region.

- 259.** The diagram represents a stage in cell division. Study the same and answer the questions that follow:



- (i) Identify the stage of cell division.

- (ii) Name the parts labelled A, B, C and D.
- (iii) Where does this type of cell division usually occur?
- (iv) Is the dividing cell shown as a plant or an animal cell? Give a reason to support your answer.

Ans :

SQP 2017

- (i) Anaphase.
- (ii) A. Spindle fibre; B. Cell wall; C. Chromatid; D. Centromere.
- (iii) In the body (somatic) cells.
- (iv) It is a plant cell as presence of cell wall, is shown clearly.

CASE BASED QUESTION

260. In living organisms, cell division is essential for growth, development, repair, and reproduction. Somatic (body) cells contain an even number of chromosomes ($2n$). Mitosis ensures the creation of identical cells for growth and repair, while meiosis produces gametes with half the chromosome number, ensuring genetic diversity in sexually reproducing organisms.

- How does mitosis contribute to tissue repair?
- Why is meiosis important for reproduction?
- What is the significance of an even number of chromosomes ($2n$) in somatic cells?
- Briefly differentiate between mitosis and meiosis.

Ans :

- Mitosis helps in tissue repair by producing identical cells to replace damaged ones.
- Meiosis is crucial for reproduction as it halves the chromosome number in gametes.
- An even chromosome number ensures proper division and genetic stability in somatic cells.
- Mitosis creates identical cells for growth, while meiosis forms gametes for reproduction.

261. Interphase is a preparatory phase where the cell grows, duplicates its DNA, and gets ready for division. It is divided into three sub-stages: G_1 phase (cytoplasm increases, and proteins are synthesized), S phase (DNA synthesis), and G_2 phase (spindle proteins for mitosis are formed). After completing interphase, the cell must divide through mitosis.

1. What happens to the chromatin material during interphase?
2. Describe the role of the G1 phase in interphase. Why is DNA synthesis important during the S phase of interphase?
3. What is the significance of the G2 phase in preparing for mitosis?

Ans :

1. The chromatin material duplicates during interphase due to DNA synthesis.
2. In the G1 phase, the cytoplasm increases, and protein synthesis occurs.
3. DNA synthesis in the S phase is crucial for duplicating genetic material before division.
4. The G2 phase prepares the cell for mitosis by synthesizing necessary spindle proteins.

262. Mitosis is the process where a single cell divides to form two identical daughter cells. It consists of two parts: karyokinesis (division of the nucleus) and cytokinesis (division of the cytoplasm). Karyokinesis includes four stages: prophase, metaphase, anaphase, and telophase. Afterward, cytokinesis splits the cytoplasm, completing the cell division.

1. What significant changes occur during prophase in both animal and plant cells?
2. What happens to the chromosomes during metaphase and how is it significant?
3. Explain how the chromatids behave in anaphase and the result of this movement.
4. Describe the process of cytokinesis in animal and plant cells.

Ans :

1. In prophase, chromosomes condense, spindle fibers form, and the nuclear membrane disappears in both plant and animal cells.
2. During metaphase, chromosomes align at the equatorial plate, ensuring equal chromosome distribution to daughter cells.
3. In anaphase, sister chromatids separate and move to opposite poles, forming two groups of chromosomes.
4. In animal cells, cytokinesis occurs through a furrow, while in plant cells, a cell plate forms to divide the cytoplasm.

263. Genes, which are specific parts of chromosomes composed of DNA, determine hereditary traits and are responsible for passing characteristics from one generation to another. Each gene occupies a fixed position in a chromosome. Human chromosomes

contain around 130,000 genes. While all body cells contain the same number of chromosomes and genes, some genes are active in all cells, like those involved in respiration. Others, like the gene for insulin production, are only active in specific cells such as the beta cells of the pancreas.

1. What is the role of genes in heredity and where are they located?
2. Why are some genes active in all cells, while others are only active in specialized cells?
3. How many genes have scientists identified in human chromosomes, and what does this suggest about genetic complexity?
4. Explain the function of the insulin-producing gene and where it is specifically active.

Ans :

1. Genes determine hereditary traits and are located in fixed positions on chromosomes.
2. Some genes are active in all cells for essential functions like respiration, while others, like insulin genes, are active only in specialized cells.
3. Scientists have identified about 130,000 genes in human chromosomes, indicating the complexity of genetic information.
4. The insulin-producing gene is functionally active only in the beta cells of the pancreas.

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CHAPTER 2

GENETICS

SUMMARY

1. GENETICS

Genetics is described as the study of transmission of body features from parents to off -springs and the laws relating to such transmission. It is the science which deals with the mechanism of heredity and variations.

2. HEREDITY

Heredity is the study of transmission of genetically based characters from parents to off-springs.

3. VARIATIONS

These are small differences among individuals. All human beings are similar but they show so many types of races due to the variations in their characters. These are observed in animals and plants. The greatest advantage of variation in a species is that they increase the chances of survival in a changing environment.

4. GENETIC ENGINEERING

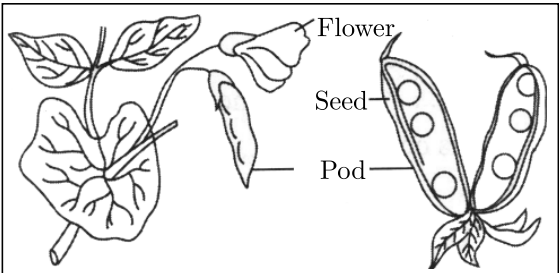
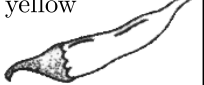
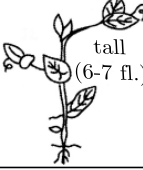
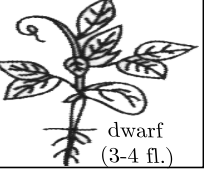
It is the technique in which the genetic constitution of an organism is altered by introducing new genes into its chromosomes.

Gregor Johann Mendel is known as “Father of Genetics”. He conducted breeding experiments on garden pea (*Pisum sativum*). The reasons for selecting garden pea for his experiments were that:

1. Many varieties were available having contrasting characters.
2. Varieties were available in pure forms.
3. Peas are self pollinated since it is bisexual.
4. Self pollination could be prevented by removing corresponding reproductive parts of the flower.
5. Cross pollination could be done artificially.
6. Reproductive span of pea plant is very small.

The seven pairs of contrasting characters used by

Mendel in his work :

			
Charactres		Dominant	Recessive
Seed Characters	shape	 round	wrinkled 
	cotyledon colour	 yellow	green 
	coat colour	 grey	white 
Pod Characters	shape	 inflated	 constricted
	colour	 green	 yellow
stem Characters	position of pod	 axial	 dwarf
	length	 tall (6-7 fl.)	 dwarf (3-4 fl.)

Deoxyribonucleic Acid (DNA) is a substance within the chromosomes that carries the hereditary instructions for producing proteins while RNA is a substance similar to DNA that transmits DNA’s instructions for making proteins from the nucleus to the cytoplasm of the cells. Diploid cells contain two sets of chromosomes, one from each parent.

5. HOMOLOGOUS CHROMOSOMES

These are a pair of corresponding chromosomes of the same shape and size, one from each parent. All genes are specific parts of chromosomes which determine hereditary characters.

6. ALLELES OR ALLELOMORPHS

These are alternative forms of gene occupying same position on homologous chromosomes and affecting the same characteristic but in different ways.

Two genes are present in a homologous pair for any one particular trait.

Normally one gene in every pair is dominant. It hides the effects of its recessive partner.

Recessive genes show their effect only if there are two of them. It is not expressed in the presence of a dominant allele.

6.1 Homozygous

It means individuals having similar gene pairs, e.g., RR, rr.

6.2 Heterozygous

It means individuals having dissimilar gene pairs, e.g., Rr.

6.3 Genotype

Genotype is the genetic constitution of an organism with regards to one or more characters, e.g., An organism may have the genetic composition RR or Rr or rr.

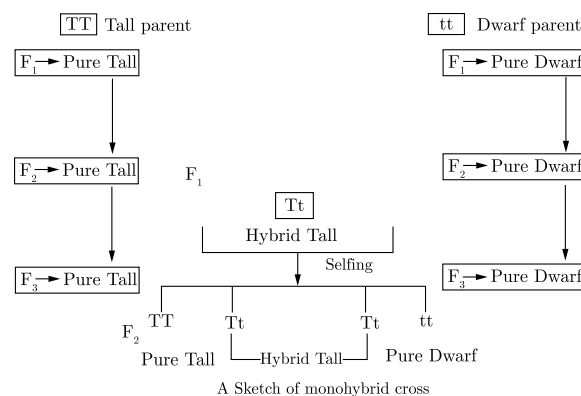
7. PHENOTYPE

Phenotype refers to the observable characters of an organism which is genetically controlled. e.g., RR and Rr both are red (externally they look same). This means that they are phenotypically same but they carry different genes and are therefore said to differ in genotype.

8. MONOHYBRID CROSSES

These are Mendelian crosses in which only one pair of contrasting character is taken into consideration at a time.

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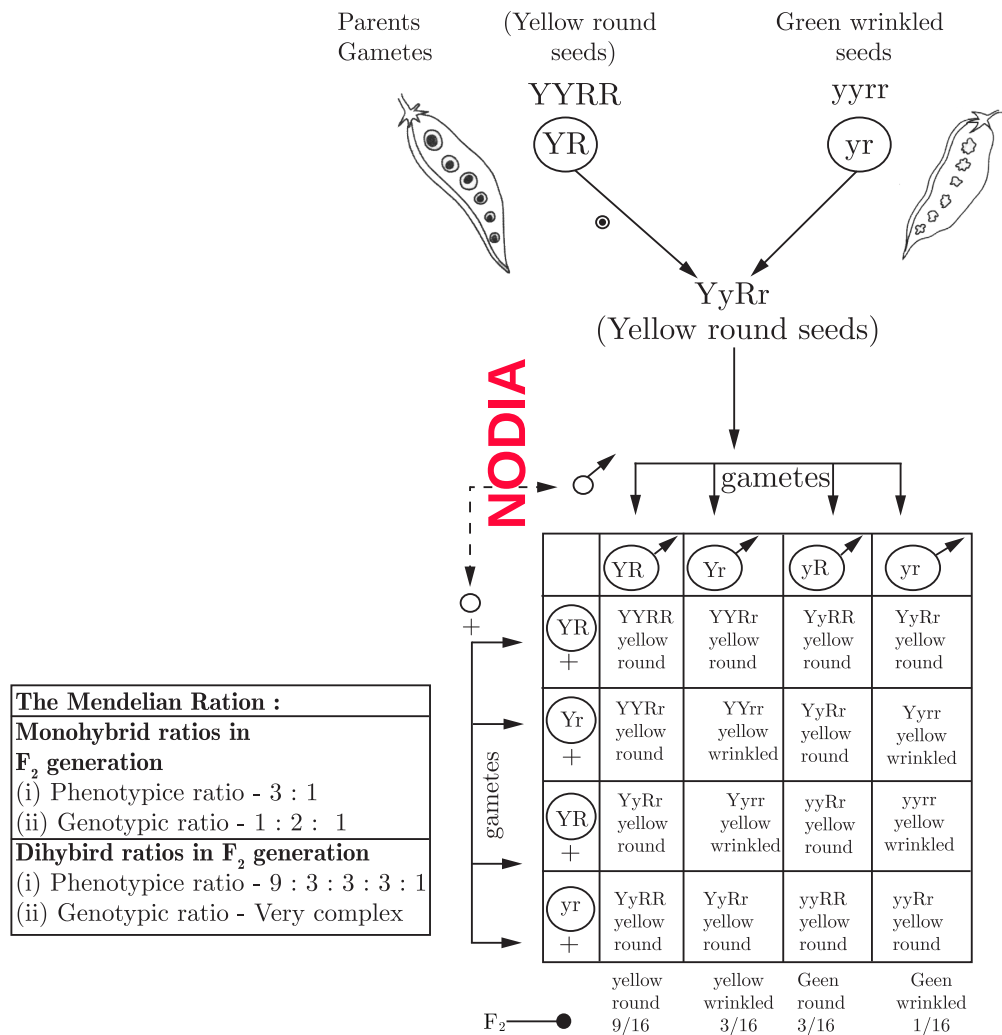
9. DIHYBRID CROSSES

These are Mendelian crosses in which two pairs of contrasting characters are taken into consideration at a time.

Mendel's Laws of Inheritance :

1. **Law of Dominance :** In heterozygous condition out of two contrasting alleles one expresses itself morphologically and the other remains unexpressed. The allele which expresses itself phenotypically in the presence of its contrasting allele is called dominant and the other which remains unexpressed is called recessive.
2. **Law of Segregation :** The two factors controlling one character segregate without influencing each other during the formation of gametes so that each gamete receives one factor for each character.
3. **Law of Independent assortment :** The factors controlling different characters assort independently without influencing each other during the formation of gametes.

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10. SEX LINKED INHERITANCE

Colourblindness, haemophilia and night blindness are some of the common X linked sex characters which are controlled by the recessive genes present on X chromosomes. These diseases are common in males than in females because both the X chromosomes may not carry the abnormal gene in the females. The gene which may be abnormal on one X chromosome being recessive, its influence will be hidden by the normal gene on the other X chromosome. The male with one X chromosome has only one gene for these diseases. If that is the abnormal gene then there is nothing on Y chromosome to mask it and hence these diseases can occur easily.

11. HYPERTRICHOSIS (LONG HAIR ON THE PINNA)

It is present on the Y chromosome only. Since Y chromosomes are found in males only that is why such traits are restricted in males only and

such genes are called holandric genes. Another example is baldness in males.

12. MUTATION

It is a sudden change in one or more genes. It alters the hereditary material of an organism's cells thereby causing changes in certain traits (characters). A mutation can effect an individual gene or an entire chromosome. The gene mutation is caused even by slight chemical changes in DNA. e.g. sickle cell anemia (a blood disease). A chromosomal mutation occurs if the number or arrangements of genes on chromosome changes, for example, Down's syndrome also called mongolism is a disorder which occurs if a person is born with one extra chromosome. (47 chromosome).

Colourblindness is checked by Ishihara cards.

Crosses between two different animals :

1. Horse + Zebra = HEBRA
2. Tiger + Lioness = TIGON
3. Lion + Tigress = LIGER

4. Bison + Buffalo = BIFFALO
5. Zebra + Horse = ZORSE
6. Zebra + Donkey = ZENKEY

MULTIPLE CHOICE QUESTION

1. A male gorilla has 48 chromosomes in each of its body cells. How many chromosomes will each of the sperms have?



- (a) 24 (b) 48
(c) 12 (d) 16

Ans :

MAIN 2024

Since a male gorilla's body cells have 48 chromosomes, each sperm cell will contain 24 chromosomes. This reduction occurs during meiosis I, where the chromosome number is halved to produce haploid cells.

Thus (a) is correct option.

2. The type of gene, which in the presence of a contrasting allele is not expressed :
- (a) Homozygous (b) Heterozygous
(c) Dominant (d) Recessive

Ans :

COMP 2021

The allele that fails to express itself in presence of its contrasting dominant allele is called a recessive allele. They can only express themselves in homozygous conditions. For example, Tt is the genotype for tallness in which "t" is the recessive allele.

Thus (d) is correct option.

3. A homozygous pea plant having purple flowers is crossed with a homozygous pea plant bearing white flowers. The phenotypic ratio of the offspring obtained in F_2 generation is :
- (a) 2 : 1 (b) 1 : 1
(c) 1 : 2 : 1 (d) 3 : 1

Ans :

MAIN 2021

Crossing a homozygous purple-flowered pea plant (PP) with a homozygous white-flowered plant (pp) produces all heterozygous purple-flowered (Pp) plants in the F_1 generation. When these F_1 plants are self-crossed ($Pp \times Pp$), the F_2 generation shows a 3:1 phenotypic ratio of purple to white flowers.

Thus (d) is correct option.

4. The genotype of a person who cannot roll his tongue is _____.
- (a) Rr (b) RR
(c) rr (d) RRr

Ans :

MAIN 2021

Tongue rolling is a dominant trait, so a person who cannot roll their tongue has the recessive genotype rr, meaning they inherited the non-rolling allele from both parents.

Thus (c) is correct option.

5. Who is known as the "Father of Genetics"?
- (a) Charles Darwin
(b) Gregor Johann Mendel
(c) Alfred Wallace
(d) Jean-Baptiste Lamarck

Ans :

SQP 2017

Gregor Johann Mendel is regarded as the "Father of Genetics" due to his pioneering work on inheritance patterns in garden peas, which laid the foundation for the laws of heredity.

Thus (b) is correct option.

6. The basic units of heredity are _____
- (a) Chromosomes (b) Chromatids
(c) Genes (d) Centrosome

Ans :

SQP 2021

A gene is a basic unit of heredity. Each gene has a specific code, and these codes are used to develop the characteristics of a person.

Thus (c) is correct option.

7. Explain the following terms :
- (i) Law of Dominance :
- (a) Out of a pair of contrasting alleles present together, only the recessive allele is able to express itself while the dominant remains suppressed.
- (b) Out of a pair of contrasting alleles present together, only the dominant allele is able to express itself while the recessive remains suppressed.

- (c) Out of a pair of contrasting alleles present together, both the dominant and recessive cannot express themselves.
- (d) Out of a pair of contrasting alleles present together, both the dominant and recessive can express themselves.

Ans :

COMP 2021

This law was proposed by Gregor Mendel, stating that in a heterozygous condition, the dominant allele will mask the effect of the recessive allele, allowing only the dominant trait to be expressed. Thus (b) is correct option.

(ii) Mutation :

- (a) It is a sudden change in one or more genes in an organism's cells which is heritable.
- (b) It is a change in the number of centrosomes in an organism's cells which is heritable.
- (c) It is a change in the structure of cell membrane in an organism's cells which is heritable.
- (d) It is a change in the shape of cells which is heritable.

Ans :

MAIN 2017

Mutations refer to changes in the genetic material (DNA or RNA), which can lead to variations in traits. These changes can be passed on to the next generation if they occur in reproductive cells. Thus (a) is correct option.

8. The recessive gene is one that expresses itself in:
- (a) Heterozygous condition
 - (b) Homozygous condition
 - (c) F_2 generation
 - (d) Y-Linked inheritances.

Ans :

COMP 2011

The recessive gene is one that expresses itself in homozygous condition. Thus (b) is correct option.

9. Rahul is studying a genetic cross between pea plants. His teacher asks him to recall the phenotypic ratio from Mendel's monohybrid cross. Monohybrid phenotypic ratio is:
- (a) 3 : 1
 - (b) 2 : 3
 - (c) 9 : 3 : 3 : 1
 - (d) 1 : 2 : 1

Ans :

SQP 2004

A monohybrid cross results in a phenotypic ratio of 3:1 (dominant to recessive), and a genotypic ratio

of 1:2:1 (homozygous dominant to heterozygous to homozygous recessive). Thus (a) is correct option.

10. Genetics is the study of:

- (a) Cells
- (b) Transmission of characters
- (c) Tissue
- (d) Origin

Ans :

MAIN 2000

The transmission of characters from one generation to the next is called heredity. This can be achieved in both asexually and sexually reproducing organisms. DNA, also known as the genetic material is responsible for the transfer of traits from parents to their offspring. Thus (b) is correct option.

11. What is the technique called where the genetic constitution of an organism is altered by introducing new genes into its chromosomes?
- (a) Genetic mutation
 - (b) Genetic engineering
 - (c) Cloning
 - (d) Gene therapy

Ans :

COMP 2011

Genetic engineering refers to the deliberate modification of the characteristics of an organism by manipulating its genetic material, often by introducing new genes into its chromosomes. Thus (b) is correct option.

12. Why did Mendel choose garden pea (*Pisum sativum*) for his experiments?

- (a) They were easy to grow
- (b) They had many varieties with contrasting characters
- (c) They had a long reproductive span
- (d) They were available in pure forms

Ans :

MAIN 2020

Mendel selected pea plants for his experiments because they had distinct varieties with easily observable contrasting traits (e.g., tall vs. short plants, round vs. wrinkled seeds), making it ideal for studying inheritance patterns. Thus (b) is correct option.

13. Riya is conducting a genetics experiment with pea plants and wants to prevent self-pollination to allow cross-pollination. What method did Mendel use to prevent self-pollination in pea plants?

- (a) Removing corresponding reproductive parts
- (b) Natural pollination
- (c) Artificial cross-pollination
- (d) Chemical treatment

Ans :

SQP 2011

Mendel prevented self-pollination by removing the reproductive parts (anthers) of the flower to ensure that cross-pollination could be performed artificially, allowing him to control the breeding process.

Thus (a) is correct option.

- 14.** Which of the following is not a reason Mendel selected garden peas for his experiments?

- (a) Peas have a small reproductive span
- (b) Peas are self-pollinated
- (c) Peas are uni-sexual
- (d) Cross-pollination could be done artificially

Ans :

MAIN 2018

Garden peas are bisexual (having both male and female reproductive organs). Mendel's experiments involved the use of bisexual flowers, where self-pollination occurs naturally, but he could prevent it by manually removing reproductive parts to conduct artificial cross-pollination.

Thus (c) is correct option.

- 15.** Which of the following is a common X-linked recessive disease?

- (a) Diabetes
- (b) Haemophilia
- (c) Influenza
- (d) Asthma

Ans :

SQP 2011

Haemophilia is an X-linked recessive disorder, along with colorblindness and night blindness, meaning the gene responsible for the disease is located on the X chromosome.

Thus (b) is the correct option.

- 16.** Why are X-linked recessive diseases more common in males?

- (a) Males have two X chromosomes
- (b) Males have one X chromosome and the Y chromosome cannot mask the abnormal gene
- (c) Females do not have X chromosomes
- (d) Males are more exposed to genetic mutations

Ans :

MAIN 2016

Since males have one X and one Y chromosome, if the X chromosome carries the abnormal gene, the disease will express itself, as there is no second X

chromosome to mask the effect.

Thus (b) is the correct option.

- 17.** Which chromosome carries the gene for colorblindness?

- (a) Y chromosome
- (b) Z chromosome
- (c) X chromosome
- (d) W chromosome

Ans :

COMP 2016

The gene for colorblindness is located on the X chromosome, which is why it is referred to as an X-linked disorder.

Thus (c) is the correct option.

- 18.** In females, why are X-linked diseases less common?

- (a) Both X chromosomes may not carry the abnormal gene, so one normal X can mask the recessive gene
- (b) Females have stronger genes
- (c) Females have a Y chromosome to compensate
- (d) Females lack the ability to carry genetic mutations

Ans :

MAIN 2010

Females have two X chromosomes. If one X chromosome carries the abnormal gene, the normal gene on the other X chromosome can mask the recessive gene's effects.

Thus (a) is the correct option.

- 19.** What happens when a male has an abnormal gene on his X chromosome?

- (a) The Y chromosome masks it
- (b) The disease occurs because there is no gene on the Y chromosome to mask it
- (c) The abnormal gene is repaired by the body
- (d) The gene causes no effect in males

Ans :

COMP 2015

Males have only one X chromosome, and if it carries an abnormal gene, the disease will manifest because the Y chromosome does not have a corresponding gene to mask it.

Thus (b) is the correct option.

- 20.** What is the primary focus of genetics?

- (a) The study of plant life
- (b) The study of animal behavior
- (c) The study of transmission of body features from parents to offspring
- (d) The study of environmental changes

Ans :

SQP 2018

Genetics is defined as the science that examines the transmission of body features from parents to offspring and the laws governing this transmission. Thus (c) is the correct option.

21. What is heredity?

- (a) The study of organisms' surroundings
- (b) The transmission of genetically based traits from parents to offspring
- (c) The creation of new species
- (d) The study of plant anatomy

Ans :

MAIN 2020

Heredity specifically refers to the passing of genetic traits from parents to their offspring. Thus (b) is the correct option.

22. What is the significance of variation in a species?

- (a) It decreases chances of survival
- (b) It helps in creating identical organisms
- (c) It increases the chances of survival in a changing environment
- (d) It has no role in survival

Ans :

Variation provides genetic diversity, which can be advantageous for adapting to environmental changes. Thus (c) is the correct option.

23. What is genetic engineering?

- (a) Study of human anatomy
- (b) Technique to alter genetic constitution by introducing new genes
- (c) Observation of plants in natural habitat
- (d) Study of animal behavior

Ans :

Genetic engineering involves modifying an organism's genetic makeup by adding new genes to its chromosomes. Thus (b) is the correct option.

24. Who is known as the "Father of Genetics"?

- (a) Charles Darwin
- (b) Gregor Johann Mendel
- (c) Robert Hooke
- (d) Alexander Fleming

Ans :

Mendel is considered the Father of Genetics due to his pioneering work on heredity using garden pea plants. Thus (b) is the correct option.

25. Which plant did Mendel use for his experiments on genetics?

- (a) Corn
- (b) Wheat
- (c) Garden pea (*Pisum sativum*)
- (d) Sunflower

Ans :

Mendel used the garden pea plant for his experiments because of its contrasting characteristics and ease of manipulation. Thus (c) is the correct option.

26. How many pairs of contrasting characters did Mendel use in his work on pea plants?

- (a) Five
- (b) Six
- (c) Seven
- (d) Eight

Ans :

Mendel used seven pairs of contrasting characters to study inheritance patterns in pea plants. Thus (c) is the correct option.

27. Why did Mendel choose the pea plant for his experiments?

- (a) It is a bisexual plant
- (b) It can self-pollinate
- (c) It has many varieties with contrasting characters
- (d) All of the above

Ans :

Mendel chose the pea plant because it is bisexual, can self-pollinate, and has distinct varieties with contrasting characteristics. Thus (d) is the correct option.

28. Which of the following did Mendel achieve by removing reproductive parts of the flower in pea plants?

- (a) Improved plant growth
- (b) Prevented self-pollination
- (c) Enhanced genetic variation
- (d) Increased flower size

Ans :

By removing reproductive parts, Mendel prevented self-pollination, allowing controlled cross-pollination for his experiments. Thus (b) is the correct option.

29. What role does variation play in species survival?

- (a) It helps in species extinction
- (b) It increases chances of survival in changing environments

- (c) It makes all organisms identical
(d) It decreases genetic diversity

Ans :

Variation increases adaptability, which can be critical for a species' survival in dynamic environmental conditions.

Thus (b) is the correct option.

ONE MARK QUESTIONS

DIRECTION : Give appropriate biological/technical terms for the following:

- 30.** A cross between one pair of contrasting characters.

Ans :

MAIN 2015

Mono-hybrid cross

- 31.** The type of gene, which in the presence of a contrasting allele is not expressed.

Ans :

SQP 2014, 2004

Recessive gene

- 32.** The physical expression of genes in an individual.

Ans :

COMP 2013

Phenotype

- 33.** A pair of chromosomes carrying dissimilar alleles for a particular character.

Ans :

MAIN 2009

Heterozygous

- 34.** A pair of corresponding chromosomes of the same size and shape, one from each parent.

Ans :

SQP 2017

Homologous chromosome

- 35.** The condition in which a pair of chromosomes carry similar alleles of a particular character.

Ans :

COMP 2018

Homozygous

DIRECTION : Fill in the blanks

- 36.** _____ is the Father of Genetics.

Ans :

SQP 2000

Gregor Johann Mendel.

- 37.** The number of chromosomes in human is _____.

Ans :

COMP 2014

46 (23 pairs)

- 38.** The small differences among individuals are called _____.

Ans :

MAIN 2008

Variations

- 39.** The dissimilar pairs of genes present in an individual are known as _____.

Ans :

MAIN 2017

Heterozygous

- 40.** _____ The chromosomes do not take part in sex determination.

Ans :

COMP 2020

Auto-somes

- 41.** _____ Is the ratio of dihybrid cross.

Ans :

SQP 2003

9 : 3 : 3 : 1

- 42.** A character that is not suppressed is _____.

Ans :

COMP 2019

Dominant gene

- 43.** Upon _____ the diploid condition is restored.

Ans :

MAIN 2010

Fertilisation

- 44.** Haemophilia is caused due to _____ gene.

Ans :

SQP 2015

Recessive

- 45.** _____ is the scientific name of garden pea, which Mendel used for his experiment.

Ans :

COMP 2023

Pisum sativum

- 46.** The number of chromosomes in the human ovary is _____.

Ans :

MAIN 2004

23

47. The alternative form of a gene is called _____.

Ans : SQP 2007

Allele

48. _____ is the genetically controlled observable characteristics of an organism.

Ans : MAIN 2009

Phenotype

49. _____ is a sex-linked disease.

Ans : SQP 2016

Colour blindness

50. The small differences among individuals are called _____.

Ans : COMP 2005

Variations

DIRECTION : Rewrite and complete the following sentences by inserting the correct word in the space indicated

51. _____ is alternate forms of genes.

Ans : MAIN 2015

Allele

52. Phenotype is the observable characteristic which is _____ controlled.

Ans : COMP 2011, 2010

Genetically

53. _____ is the scientific name of garden pea, which Mendel used for his experiments.

Ans : SQP 2015

Pisum sativum is the scientific name of garden pea, which Mendel used for his experiments.

54. The suppressed allele of a gene.

Ans : MAIN 2017

Recessive allele

DIRECTION : State whether the following statements are True or False. If false, rewrite the correct statement :

55. Chromosomes other than the pair of sex chromosomes are called alleles.

Ans :

COMP 2011

False. Chromosomes other than the pair of sex chromosomes are called autosomes.

56. The chemical substance present in gene is RNA.

Ans : SQP 2012

False. The chemical substance present in gene is DNA.

57. When both the alleles are identical, they are said to be homozygous.

Ans : MAIN 2020

True.

58. The genetic make up of an organism is phenotype.

Ans : SQP 2018

False. The genetic make up of an organism is genotype.

59. The two arms of a chromosome is called centromere.

Ans : MAIN 2004

False. The two arms of a chromosome is called chromatids.

60. The plant used by Mendel is sweet pea.

Ans : COMP 2000

False. The plant used by Mendel is garden pea.

61. When both the alleles are different, they are said to be homozygous.

Ans : SQP 2008

False. When both the alleles are different, they are said to be heterozygous.

62. The plant used by Mendel was sweet pea.

Ans : MAIN 2023

False. The plant used by Mendel was garden pea

63. The number of chromosomes in man is 23.

Ans : SQP 2020

False. The number of chromosome in man is 46.

64. Suppressed character is always the recessive character.

Ans : COMP 2016

True.

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DIRECTION : Give one point of difference between the following on the basis of what is given in the bracket

65. Genotype and Phenotype. (definition)

or

Differentiate between genotype and phenotype.

Ans :

MAIN 2010, 2004

Genotype is the genetic make up of an organism. Phenotype is the external appearance of an organism

DIRECTION : Give scientific reasons for the following statements:

66. Colour blindness is more common in men than in women.

Ans :

SQP 2016

It is due to recessive genes being present on X chromosomes. As males have one X chromosome only, so the genetic traits that are sex-related are easily seen in men than in women.

DIRECTION : Given below are groups of terms. In each group the first pair indicates the relationship between the two terms. Rewrite and complete the second pair on a similar basis.

67. Example : Oxygen : Inspiration :: Carbon dioxide : Expiration
TT : Homozygous :: Tt : _____

Ans :

COMP 2017

TT : Homozygous :: Tt : Heterozygous

DIRECTION : Define the following :

68. Alleles

or

Define by giving an example : Allele.

Ans :

MAIN 2012, 2003

The alternative forms of a gene for a character producing different effects are called alleles. For example, one allele of the gene for colour of hair produces black hair and another allele produces brown hair.

69. Monohybrid cross

Ans :

COMP 2014

It is a cross which is carried out by taking only one pair of contrasting character at a time.

70. Gene

Ans :

SQP 2013

A gene is the basic unit of heredity, and are located on chromosome.

71. Phenotype

Ans :

SQP 2017

The physical appearance of an organism is called phenotype, e.g. dark colour, long hair, etc.

72. Homologous chromosomes

Ans :

MAIN 2010

A pair of corresponding chromosomes of the same size and shape, one from each parent.

73. Variation

Ans :

COMP 2000

Variations are the differences shown by individuals of a species or offspring of the same parents.

74. Law of dominance

Ans :

MAIN 2005

Out of a pair of contrasting characters present together in an offspring, one expresses while the other remains hidden. This law is called the law of dominance.

75. Linkage

Ans :

SQP 2007

Linkage is the tendency of genes to stay together in hereditary transmission.

76. Homozygous

Ans :

MAIN 2002

Homozygous is the condition in which both the alleles are identical.

77. Heredity

Ans :

MAIN 2020

The transmission of genetically based characteristics from the parents to the offspring.

78. Genetics

Ans :

COMP 2012

Genetics is the branch of biology which deals with the study of transmission of characters from parents to offspring.

79. Trait

Ans : SQP 2001
A quality or characteristic that can belong to only a person.

80. Mutation

Ans : MAIN 2022
Mutation is the sudden change in a gene which alters the hereditary materials of an organism.

DIRECTION : Identify the odd term in following set and name the category to which the remaining three belong.

81. Typhoid, Haemophilia, Albinism, Colour blindness.

Ans : MAIN 2016
Typhoid, all others are congenital genetic disorders.

82. Chicken pox, Colour blindness, Haemophilia, Albinism.

Ans : COMP 2019
Chickenpox : others are hereditary traits/genetic defects.

DIRECTION : Name the following:

83. Father of Genetics.

Ans : MAIN 2023
Gregor Johann Mendel

84. The branch of science which deals with heredity.

Ans : COMP 2020
Genetics

85. What is DNA?

Ans : SQP 2018
The DNA is the chemical basis of gene. It controls all the biosynthetic processes of the cell.

86. The chromosomes responsible for sex determination.

Ans : MAIN 2011
Sex Chromosomes

87. A hereditary disease in which blood does not clot.

Ans : COMP 2008

Haemophilia

88. The unit of heredity.

Ans : SQP 2001
Genes

89. Number of pairs of autosomes in humans.

Ans : MAIN 2015
22 pairs

90. The condition in which both the alleles are identical

Ans : COMP 2010
Homozygous

91. Monohybrid ratio.

Ans : MAIN 2019
3 : 1

92. The chemical substance which constitutes genes.

Ans : SQP 2008
DNA

93. The sex chromosomes of male.

Ans : COMP 2003
X and Y

94. The allele which expresses itself on the other.

Ans : SQP 2009
Dominant

95. One genetic disease.

Ans : MAIN 2001
Haemophilia

96. The genetic make up of an organism.

Ans : COMP 2017
Genotype

97. Two sex-linked inherited diseases.

Ans : SQP 2007
Haemophilia and colour blindness

98. The pair of genes responsible for a particular characteristics in an individual.

Ans : MAIN 2014
Alleles

99. The plant on which Mendel had worked.

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Ans :

SQP 2022

Garden pea (*Pisum sativum*).**100.** A sudden heritable change in the gene.

Ans :

MAIN 2009

Mutation.

101. The scientific name of garden pea.

Ans :

COMP 2020

*Pisum sativum***102.** Two sex linked inherited diseases.

Ans :

SQP 2013

Colourblindness and Haemophilia

103. The chemical substance which constitutes genes.

Ans :

COMP 2023

Deoxyribonucleic acid

104. The second law of Mendel.

Ans :

SQP 2002

Law of Independent Assortment

105. An alteration in genetic material that can be inherited.

Ans :

MAIN 2010

Mutation

DIRECTION : Choose the correct option from the brackets :**106.** The chemical substance which constitutes the gene is _____ (RNA, DNA, ATP, ADP).

Ans :

SQP 2017

DNA

107. The number of pairs of autosomes in humans is _____ (19, 22, 23, 46).

Ans :

MAIN 2011

22

108. The process of producing genetically identical organism from a single parent is called _____. (linkage, variation, cloning, mutation)

Ans :

COMP 2019

Cloning

109. The dihybrid phenotypic ratio is _____. (3 : 1, 2 : 1, 1 : 2 : 1, 9 : 3 : 3 : 1)

Ans :

SQP 2006

9 : 3 : 3 : 1

110. Which of the following is the genetic X-linked disease? _____. (Haemophilia, Painting, Black Hair, Singing)

Ans :

MAIN 2007

Haemophilia

DIRECTION : Give one point of difference between the following on the basis of what is given in the bracket:**111.** Pure and Hybrid strains. (Definition)

Ans :

SQP 2020

Pure strains : An organism with same characters as that of the parents, e.g. for red flower (RR) **Hybrid strains :** Organisms with dual characteristics, e.g. (Rr)**112.** Phenotype and Genotype.

Ans :

MAIN 2023

Phenotype : The characters which are visible from outside in an organism.**Genotype :** The characters which are not visible from outside in an organism.**113.** Give an example of an established genetic trait in human being.

Ans :

COMP 2005

Colour blindness.

114. What is genome?

Ans :

MAIN 2006

It is the full complement of DNA in an organism.

115. A dog and a chicken have 78 chromosomes. But they are different from each other in many aspects. Why?

Ans :

SQP 2017

Though they have the same number of chromosomes, the variations are due to the presence of genes on the chromosomes.

116. Gametes are always pure. Comment.

Ans :

MAIN 2009

Gametes are generally sex cell that are either egg or sperm. They are pure because they are always haploid.

117. What is meant by emasculation in plants?

Ans : COMP 2004

Emasculation is a process used in plant breeding. It is done to remove anthers from bisexual flowers without disturbing the pistil of the flower.

118. What is the difference between monohybrid and dihybrid cross (Phenotypic ratio) ?

Ans : SQP 2016

Monohybrid phenotypic ratio = 3 : 1
Dihybrid phenotypic ratio = 9 : 3 : 3 : 1

119. What are autosomes ?

Ans : MAIN 2023

The chromosomes that do not have genes for sex determination are called autosomes.

120. What is a phenotype ?

Ans : SQP 2021

The observable characteristics of an organism that are genetically controlled is called phenotype.

121. Define variations.

Ans : MAIN 2006

The differences which occur in closely related organisms are called variations.

122. If a color blind man marries a woman with normal vision, what will be the nature of their children ?

Ans : COMP 2003

Their daughter will be a carrier of colourblindness but their son will have normal vision.

TWO MARKS QUESTIONS

123. Give scientific reason for the statement Colour blindness is more common in men than in women.

Ans : COMP 2016

Colorblindness is more common in men as compared to women because it is a sex-linked and recessive trait. It need two alleles for its expression in women as she contains 2 X-chromosomes

whereas only one X-chromosome is present in males, hence a single gene expresses it.

124. (i) State Mendel's law of dominance.
(ii) State Mendel's law of segregation.

Ans : MAIN 2025, 2015

- (i) **Law of Dominance** : Out of a pair of contrasting characters present together in an offspring, one dominates over the other.
(ii) **Law of Segregation (First Law of Mendel)** : The contrasting factors or characters (alleles) separate during gamete formation. At the time of zygote formation, the gametes combine randomly but alleles or characters do not blend and separate during gamete formation.

125. In a certain species of animals black fur (B) is dominant over brown fur (b). Predict a genotype and phenotype of the offspring when both parents are Bb or have heterozygous black fur.

Ans : MAIN 2004

	B	b	
B	BB	Bb	Genotype : 25% BB (Homozygous black ful) 25% bb (Homozygous black ful) 50% Bb (Homozygous black ful)
b	Bb	bb	
			Phenotype : 75% (Black ful) 25% (Black ful)

126. What is genetic disease? Name two genetic diseases.

Ans : MAIN 2017

Sex-linked human traits are mostly on X chromosomes. Most of these concern human diseases are carried by recessive genes. Haemophilia and colour blindness are the two genetic diseases.

127. Explain the structure of a chromosome.

Ans : SQP 2023

At metaphase, chromosome during cell division condense and then undergo replication. Each chromosome consists of two identical replication called chromatids that are joined at a point called centromere. Chromosome contain genes, responsible for transmission of characters from one generation to another generation.

128. (i) Name the type of genes, which in the presence of a contrasting allele, is not expressed.
(ii) Name two animals which have nineteen pairs of chromosomes.

Ans :

COMP 2010

- (i) Recessive
- (ii) Cat, sheep.

- 129.** What is a pure strain and how it is different from a hybrid strain ?

Ans :

COMP 2018

The self pollinated progeny of a homozygous plant is a pure strain while offspring of genetically dissimilar parents is a hybrid strain. These offspring are obtained by artificial pollination.

- 130.** The sex of the child depends upon its father. Explain.

Ans :

SQP 2017

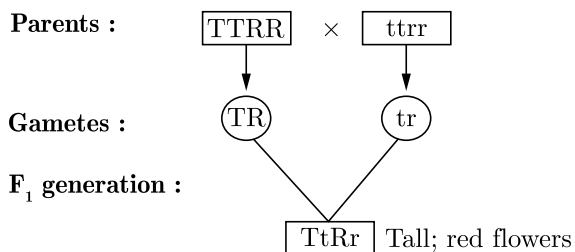
Sex chromosomes of female are homozygous (XX) while in male it is heterozygous XY. If a sperm bearing X chromosome fertilizes with the ovum, XX zygote formed is a female child. If a sperm bearing Y chromosome fertilizes with the ovum, XY zygote formed, i.e. a male child. So the sex of a child depends upon its father.

- 131.** A pure tall plant bearing red coloured flowers was crossed with a pure dwarf plant with white flowers. What would be the nature of offspring in the F_1 generation?

Ans :

MAIN 2011

In the F_1 generation, all plants will be tall and bear red coloured flowers, i.e.



- 132.** How is sex determined in humans?

Ans :

SQP 2002

In humans, the male contains X and Y sex chromosomes and the female contains XX chromosomes. If the sperm bearing the X chromosome fertilizes the ovum, the zygote is XX, i.e. a female child. If the sperm bearing Y chromosome fertilizes the ovum, the zygote is XY, i.e. a male child.

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THREE MARKS QUESTIONS

- 133.** Answer the following :

- (i) What is DNA?
- (ii) State the difference between autosomes and sex chromosomes.
- (iii) Mutation

Ans :

MAIN 2015

- (i) The DNA is the chemical basis of gene. It controls all the biosynthetic processes of the cell.
- (ii)

	Autosomes		Sex Chromosomes
(i)	They do not participate in sex determination.	(i)	They determine the sex of an individual.
(ii)	They are of one type.	(ii)	They are of two types : X and Y.

- (iii) **Mutation :** The sudden change in one or more genes, which change the hereditary materials of an organism and ultimately change the character of an organism. It may be :

- (a) **Gene Mutation :** Changes in the DNA, Sickle-cell anemia is caused due to gene mutation where chemical changes occur in the DNA.
- (b) **Chromosomal Mutation :** Changes in the number or arrangement of the chromosome. Chromosomal mutation are the changes in the arrangement on number of chromosomes as seen in Down's syndrome.

- 134.** Why did Mendel select garden pea for his experiments?

Ans :

SQP 2014

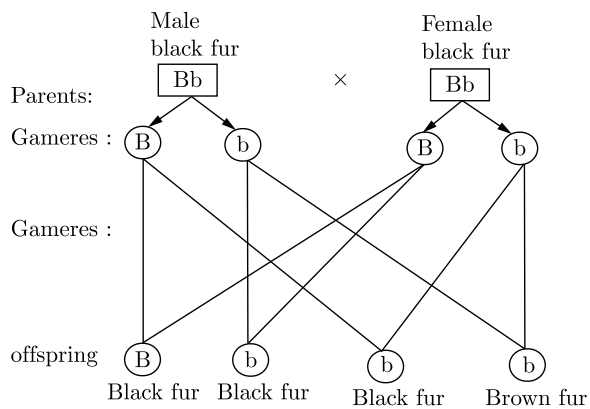
He selected garden pea because

- (a) Pea plant has bisexual flowers.
- (b) Many varieties were available in alternative forms.
- (c) It is an annual plant.
- (d) The varieties were in pure forms that bred true.
- (e) It was easily available.
- (f) It has a short life cycle.
- (g) Handling the plant was easy.
- (h) Large number of off-springs were produced in a single generation.
- (i) It could be easily artificially pollinated and the hybrids produced were fertile.

- 135.** In a certain species of animals black fur (B) is dominant over brown fur (b). Predict a genotype and phenotype of the offspring when both parents are Bb or have heterozygous black fur.

Ans :

COMP 2009



Phenotype : Black – 3/4

Brown – 1/4

Genotype : BB (Homozygous black) – 1/4

Bb (Homozygous black) – 2/4

bb (Homozygous brown) – 1/4

- 136.** Match the following Column :

	Column A		Column B
(i)	Dominant gene	(a)	Similar chromosomes of the same shape and size.
(ii)	Genetics	(b)	Sudden change in a gene.
(iii)	Sex chromosomes	(c)	The expressed gene of an allele.
(iv)	Mutation	(d)	The study of inheritance of characters.
(v)	Homologous chromosomes	(e)	Determine the sex of a child.

Ans :

MAIN 2004

	Column A		Column B
(i)	Dominant gene	(c)	The expressed gene of an allele.

(ii)	Genetics	(d)	The study of inheritance of characters.
(iii)	Sex chromosomes	(e)	Determine the sex of a child.
(iv)	Mutation	(b)	Sudden change in a gene.
(v)	Homologous chromosomes	(a)	Similar chromosomes of the same shape and size.

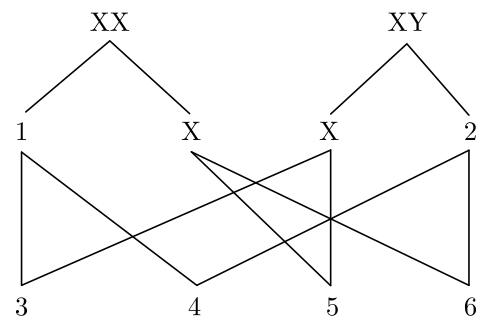
- 137.** (i) Explain the following terms :
 1. Monohybrid cross, 2. Gene, 3. Phenotype
 (ii) Name the two sex-linked diseases in males.
 (iii) State Mendel's law of segregation.

Ans :

SQP 2009

- (i) 1. **Monohybrid cross** : A cross or breeding between two individuals having one pair of contrasting traits producing all hybrid (heterozygous) generation for that character.
 2. **Gene** : These are the specific parts of a chromosome (DNA segments), which determine the heredity characters.
 3. **Phenotype** : The morphological (observable) expression of any character of an individual.
 (ii) (1) Colourblindness
 (2) Haemophilia
 (iii) Mendel's law of segregation states that the two factors or genes controlling one character separate or segregate without blending or influencing each other during the formation of gametes so that each gamete receives one factor or gene for each character.

- 138.** The figure shows sex determination in humans.



- (i) What are the right substitutes for the numbers 1 to 6 ?
 (ii) What is the sex of individuals represented by

numbers 3, 4, 5 and 6 ?

- (iii) Who is responsible for the sex of offspring - male or female ? Why ?

Ans :

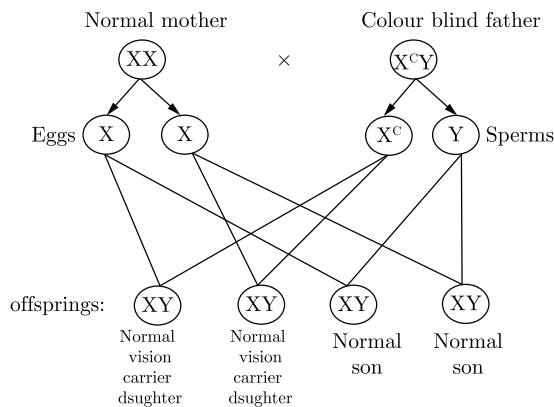
COMP 2012

- (i) 1 - X 2 - Y 3 - XX
4 - XY 5 - XX 6 - XY
- (ii) 3 - female 4 - male
5 - female 6 - male
- (iii) Males are responsible for the sex of offspring because males have X and Y chromosomes, if this Y chromosome combines with X chromosome of female, a male child results if X chromosome combines with other X chromosome, female child results.

139. Find out the progeny of a marriage between a normal man and a carrier haemophilic woman.

Ans :

MAIN 2006

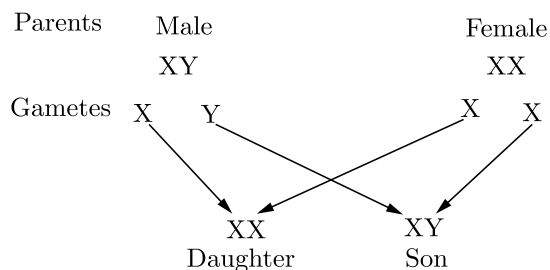


140. There is a 50-50% chance for getting a male or female child. Justify.

Ans :

SQP 2006

The sex of a child depends upon the kind of sperm that fertilises the egg. Male sperm has X and Y chromosomes while females have X chromosomes only. If a sperm bearing an X chromosome fuses with the egg, the child is a daughter (XX) and if sperm bearing Y-chromosome fuses with the egg, the child is a son (XY).



Therefore, there is a 50% chance of the child being a boy or a girl.

141. A pea plant with pure yellow (YY) round (RR) seeds were crossed with a plant having pure green (yy) wrinkled (rr) seeds.
- (i) What would be the nature of the offspring in the F₁ generation ?
- (ii) If the offspring of the F₁ generation are self-pollinated, what would be the phenotypic ratio in F₂ generation ?
- (iii) Which law is illustrated in part (ii)?

Ans :

MAIN 2008

- (i) F₁ offspring will be all yellow round.
- (ii) Yellow round : Yellow wrinkled : Green round : Green wrinkled = 9 : 3 : 3 : 1
- (iii) Law of independent assortment.

142. Distinguish between:

- (i) Dominant allele and recessive allele.
- (ii) Mono-hybrid and di-hybrid cross.

Ans :

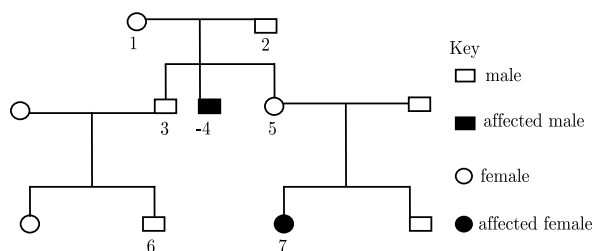
MAIN 2020

	Dominant allele		Recessive allele
(a)	Similar pair of chromosomes.	(a)	Dissimilar pair of chromosomes.
(b)	The expressed allele.	(b)	The suppressed allele.

- (ii)

Mono-hybrid cross	Di-hybrid cross
Cross which is carried out by taking only one pair of contrasting character at a time.	Cross which is carried out by taking two pairs of contrasting character at a time.

143. The figure shows a family pedigree to show the inheritance of haemophilia.



- (i) Is the allele for haemophilia dominant or recessive ?
- (ii) State with reasons the genotype of individuals 1, 2 and 4.

- (iii) What are the possible genotypes of individuals 3 and 5 ?

Ans :

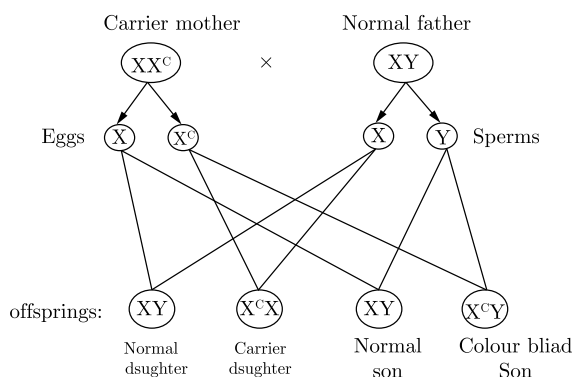
MAIN 2000

- (i) Recessive
 (ii) Individuals 1 and 2 are heterozygous since they are normal but produced an affected child. Individual 4 is homozygous recessive since the allele is recessive and individual must have two copies of the allele to be affected.
 (iii) Individual 3 and 5 are normal but the information presented is not sufficient to determine whether they are homozygous dominant or heterozygous.

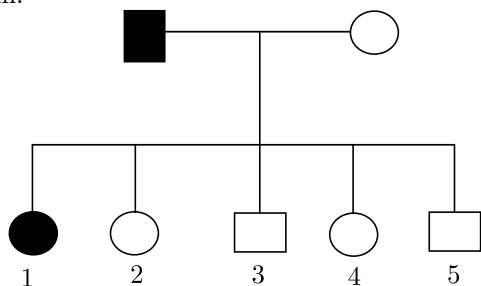
144. Find out the progeny of a marriage between a colour blind man and a carrier woman.

Ans :

COMP 2001



145. A family consists of two parents and they have five children. The pedigree chart below shows the inheritance of the trait of colour blindness in them.



- (i) Name the colour blind parent-mother or father.
 (ii) How many children are born that have colour blindness?
 (iii) What about the other children? Explain.

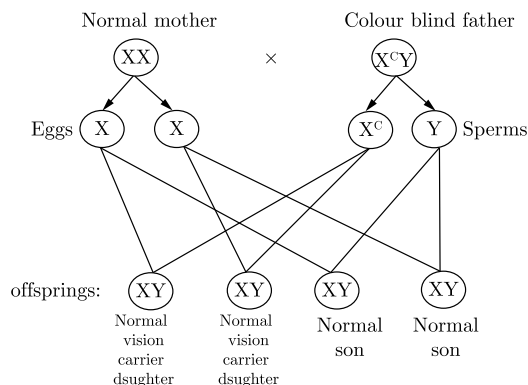
Ans :

COMP 2015

- (i) Father.

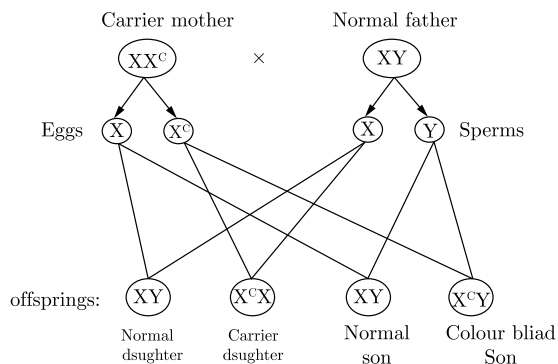
- (ii) Daughters as the trait is sex linked inheritance. However the daughters are only the carrier of the gene with normal visions. Normally, only male show colour blindness.
 (iii) Colour blindness is a sex-inherited disease in which a person cannot discriminate between certain colours such as red and green. It is due to a recessive gene on X chromosome. It can be explained by the given charts:

Case - I



All the male offspring have normal vision but daughters are carriers.

Case - II



The colour blindness is inherited by the son if mother is the carrier of the recessive gene. Therefore, it is called sex-linked inheritance as the gene is passed from mother to son or from father to daughter.

146. If a homozygous pure tall plant (T) is crossed with a homozygous pure dwarf plant (t), what will be the appearance of :
 (i) F₁ progenies
 (ii) F₂ progenies

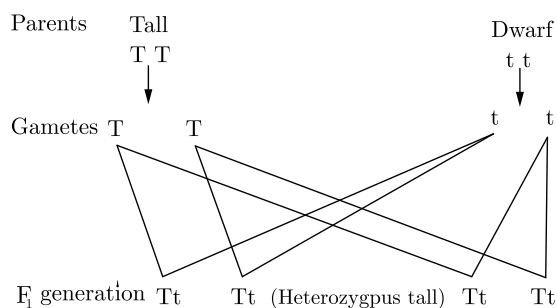
Ans :

SPQ 2004

Homozygous (pure) tall plant is designated as – TT

Homozygous (pure) dwarf plant is designated as – tt

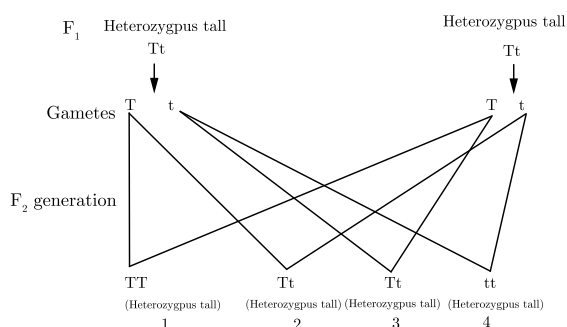
- (i) A cross between homozygous tall parent and homozygous dwarf parent will be :



The progenies of F₁ generation will be all heterozygous tall (hybrids)

- (ii) The F₁ hybrids are self pollinated and crossed to produce F₂ progenies as follows :

Three plants will be tall and one plant will be dwarf in F₂ generation. Out of three tails one will be homozygous and two will be heterozygous.



147. Give any three points of difference between monohybrid and dihybrid cross.

Ans :

SQP 2019

The difference between monohybrid and dihybrid cross are as follows :

	Monohybrid cross		Dihybrid cross
1.	It yields a phenotypic ratio of 3 : 1 in F ₂ generation.	1.	It yields a phenotypic ratio of 9 : 3 : 3 : 1 in F ₂ generation.
2.	Law of independent assortment is not applicable.	2.	Law of independent assortment is applicable.

3.	Crosses involve a single pair of alleles.	3.	Crosses involve two pair of alleles.
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FIVE MARKS QUESTIONS

148. In a homozygous pea plant, axial flowers (A) are dominant over terminal flowers (a).

- What is the phenotype and genotype of the F₁ generation if a plant bearing pure axial flowers is crossed with a plant bearing pure terminal flowers?
- Draw a Punnett square board to show the gametes and off-springs when both the parent plants are heterozygous for axial flowers.
- What is the phenotypic ratio and genotypic ratio of the above cross shown in (ii)?
- State Mendel's Law of Dominance.
- Name two genetic disorders commonly seen in human males.

Ans :

SQP 2017

- Phenotype – Axial flowers
Genotype – Aa
- Heterozygous Heterozygous

Heterozygous Axial flowers	Heterozygous axial flower
Aa	Aa

Gametes : Aa Aa

Punnett square:

	A	a
A	AA	Aa
a	Aa	aa

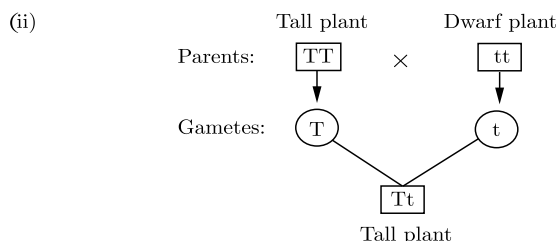
- Phenotype ratio: 3 axial flower : 1 terminal flower (3 : 1)
Genotype ratio: 1 AA : 2 Aa : 1 aa (1 : 2 : 1)
 - Law of Dominance states that out of a pair of contrasting characters present together, one express itself while the other remain hidden.
 1. Colour blindness,
2. Haemophilia
149. (i) State Mendel's Law of Dominance.
(ii) A pure tall plant (TT) is crossed with a pure dwarf plant (tt). Draw Punnett squares to show (1) F₁ generation (2) F₂ generation.
(iii) Give the Phenotype of the F₂ generation.

- (iv) Give the Phenotypic and Genotypic ratio of the F_1 and F_2 generation.
- (v) Name any one X-linked disease found in humans.

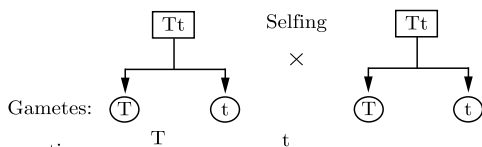
Ans :

MAIN 2010

- (i) When two homozygous parents with a pair of contrasting characters are crossed, the characters that appear in the first generation are dominant characters and those that do not appear in the first generation are recessive characters.



- (1) F_1 generation



- (2) F_2 generation

TT Tall plant	Tt Tall plant
Tt Tall plant	tt Dwarf plant

- (iii) Phenotype of F_2 generation
Tall plant - 3/4
Dwarf plant - 1/4

- (iv)

Phenotypic ratio	Genotypic ratio
F_1 generation : Tall plant 1	Tt 1
F_2 generation : Tall : Dwarf 3 : 1	TT : Tt : tt 1 : 2 : 1

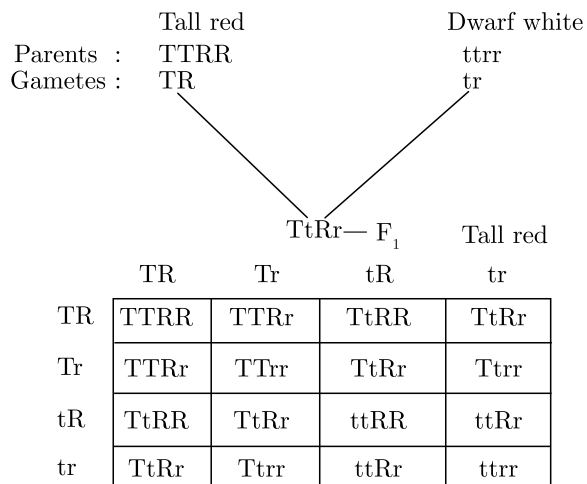
- (v) Haemophilia/Colour blindness

- 150.** A homozygous tall plant (T) bearing red coloured (R) flowers is crossed with a homozygous dwarf (t) plant bearing white (r) flowers:
- (i) Give the genotype and phenotype of the plants of F_1 generation.
- (ii) Mention the possible combinations of the gametes that can be obtained from the F_1 hybrid plant.
- (iii) State the Mendel's law of Independent Assortment.

- (iv) Mention the phenotypes of the offsprings obtained in F_2 generation.
- (v) What is the phenotypic ratio obtained in F_2 generation?

Ans :

COMP 2016



- (i) Genotype - TtRr
Phenotype - Tall red
- (ii) Gametes - TR, Tr, tR, tr
- (iii) When two pairs of contrasting characters are crossed, the distribution of the members of one pair into the gametes is independent of the distribution of the other pair.
- (iv) Phenotypes - Tall red, Tall white, Dwarf red, Dwarf white
- (v) Phenotypic ratio = 9 : 3 : 3 : 1.

- 151.** A homozygous plant having round (R) and yellow (Y) seed is crossed with homozygous plant having wrinkled (r) and green (y) seeds:

- (i) Give the scientific name of the plant on which Mendel conducted his hybridization experiments.
- (ii) Give the genotype of the F_1 generation.
- (iii) Give the dihybrid phenotypic ratio and the phenotype of the offspring of the F_2 generation when two plants of the F_1 generation are crossed.
- (iv) Name and state the law which explains the dihybrid ratio.
- (v) Give the possible combinations of gametes that can be obtained from F_1 hybrid.

Ans :

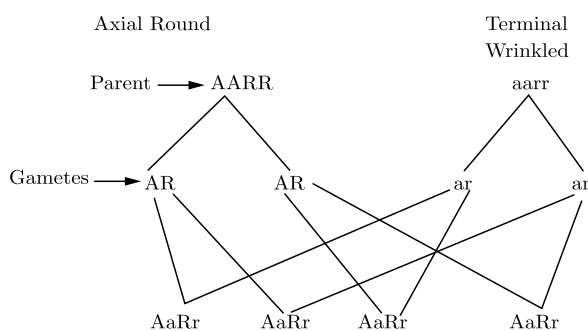
COMP 2012

- (i) Pisum sativum
- (ii) RrYy
- (iii) Dihybrid phenotypic ratio 9 : 3 : 3 : 1
The phenotypes are round, yellow ; wrinkled

yellow ; round green and wrinkled green.

- (iv) Law of Independent Assortment states that if the inheritance of two pairs of characters is studied, the factors for each pair of characters assort out independent of the other pair.
- (v) RY, Ry, rY, ry

- 152.** Given below is a schematic diagram showing Mendel's Experiment on sweet pea plants having axial flowers with round seeds (AARR) and terminal flowers with wrinkled seeds (aarr). Study the same and answer the questions that follow:



- Give the phenotype of F_1 progeny.
- Give the phenotypes of F_2 progeny produced upon by the self-pollination of F_1 progeny.
- Give the phenotypic ratio of F_2 progeny.
- Name and explain the law induced by Mendel on the basis of the above observation.

Ans :

SQP 2013

- Axial flowers with round seeds.
- Axial round, Axial wrinkled, Terminal round, Terminal wrinkled.
- 9.3.3.1
- Law of independent assortment – When there are two pairs of characters, then the distribution of each pair to the gametes is independent of the distribution of the other pair of character.

- 153.** In a homozygous plant, round seeds (R) are dominant over wrinkled seeds (r):

- Draw a Punnett square to show the gametes and offspring when both the plants have heterozygous round seeds (Rr).
- Mention the Phenotype and Genotype ratios of the off-springs in F_2 generation.
- Name the sex chromosomes in human males and females.
- Briefly explain the term 'Mutation'.
- What is the number of chromosomes in the gametes of human beings?

Ans :

MAIN 2015

- (i)

	R	r	
R	RR	Rr	F ₂ generation
r	Rr	rr	

- Phenotype ratio : 3 : 1
Genotype ratio : 1 : 2 : 1
- Human male : XY chromosomes
Human Female : XX chromosomes
- A sudden change in one or more genes which alters the hereditary materials of an organism.
- 23 chromosomes.

- 154.** In Mendel's experiments, tall pea plants (T) are dominant over dwarf pea plants (t).

- What is the phenotype and genotype of the F_1 generation if a homozygous tall plant is crossed with a homozygous dwarf plant ?
- Draw a Punnett square board to show the gametes and offspring when both the parents are heterozygous for tallness.
- What is the phenotypic ratio and genotypic ratio of the above cross in (ii)?
- State Mendel's Law of Dominance.
- What is a Dihybrid Cross ?

Ans :

COMP 2019

- Phenotype of F_1 generation is all are tall plants. Genotype of F_1 generation is all plants are Tt.
- Punnett square is as follows :

♂ T	T	t
♀ T	TT	Tt
♀ t	Tt	tt

- Phenotypic ratio = 3 : 1
Genotypic ratio = 1 : 2 : 1
- In a heterozygous condition, out of the two contrasting alleles, one expresses itself morphologically and other remains unexpressed. The factor which expresses itself phenotypically is called dominant and the other which remains unexpressed is called recessive.
- A cross between two individuals having two pairs of contrasting traits producing a generation in which all individuals are heterozygous for both the characters.

155. Define the following :

- (i) Genetics
- (ii) Genetic engineering
- (iii) Genes
- (iv) Genome
- (v) Alleles
- (vi) Punnett square

Ans :

SQP 2018

- (i) **Genetics** : Genetics is the study of transmission of body features (both similarities and differences) from parents to offspring and the laws related to such transmission.
- (ii) **Genetic engineering** : is the technique in which the genetic constitution of an organism (bacterium) is altered by introducing new genes into its chromosomes.
- (iii) **Genes** : Genes are the specific parts (DNA segments) of a chromosome, which determine the hereditary characters.
- (iv) **Genome** : It is the full complement of DNA (including all genes and the intergenic regions).
- (v) **Alleles** : Alternative forms of gene, occupying the same position on homologous chromosomes and affecting the same characteristics but in different ways.
- (vi) **Punnett square** : It is a simple diagram in which the different types of gametes (sex cells with the concerned trait) of one (female) parent are placed along one side of the square and those of the other parent (male) are placed along the other side.

156. In a homozygous plant round seeds (R) are dominant over wrinkled seeds (r) :

- (i) Draw a Punnett square to show the gametes and offspring when both the plants have heterozygous round seeds (Rr).
- (ii) Mention the Phenotype and Genotype ratios of the offsprings in F_2 generation.
- (iii) Name the sex chromosomes in human males and females.
- (iv) Briefly explain the term 'Mutation'.
- (v) What is the number of chromosomes in the gametes of human beings?

Ans :

MAIN 2020

- (i) The Punnett square is as follows:

	R	r
R	RR	Rr
r	Rr	rr

- (ii) Phenotype:-

9 : 3 : 3 : 1

Genotype :-

RRYY – 1	RrYY – 2	rrYY – 1
RRYy – 2	RrYy – 4	rrYy – 2
RRyy – 1	Rryy – 2	rryy – 1

- (iii) The name of sex chromosomes in human males and females is Allosomes/Idiosomes.
- (iv) Mutation is a sudden change in one or more gene or in the number and structure of chromosomes in the progeny causing changes in certain traits, which may not have existed in parents, grandparents or even great grandparents.
- (v) The number of chromosomes in the gametes of human beings is 46.

157. A pea plant which is homozygous for Green pods which are inflated [GGII] is crossed with a homozygous plant for yellow pods which are constricted [ggii]. Answer the following questions:

- (i) Give the phenotype and genotype of the F_1 generation.
Which type of pollination has occurred to produce F_1 generation?
- (ii) Write the phenotypic ratio of the F_2 generation.
- (iii) Write the possible combinations of the gametes that can be obtained if two F_1 hybrid plants are crossed.
- (iv) State Mendel's law of 'Segregation of Gametes'.
- (v) What is the scientific name of the plant which Mendel used for his experiments on inheritance?

Ans :

SQP 2018

- (i) Phenotype of F_1 generation – All plants with green coloured pods and with inflated pod shape
Genotype of F_1 generation – All plants with GgIi
Cross pollination.
- (ii) 9 : 3 : 3 : 1
- (iii) Possible combinations of gametes are as follows GI, Gi, gI, gi
- (iv) The two factors or genes controlling one character separate or segregate without blending or influencing each other during the formation of gametes so that each gamete receives one factor or gene for each character.

or

Two members of a pair of factors separate during the formation of gametes.

(v) *Pisum sativum*

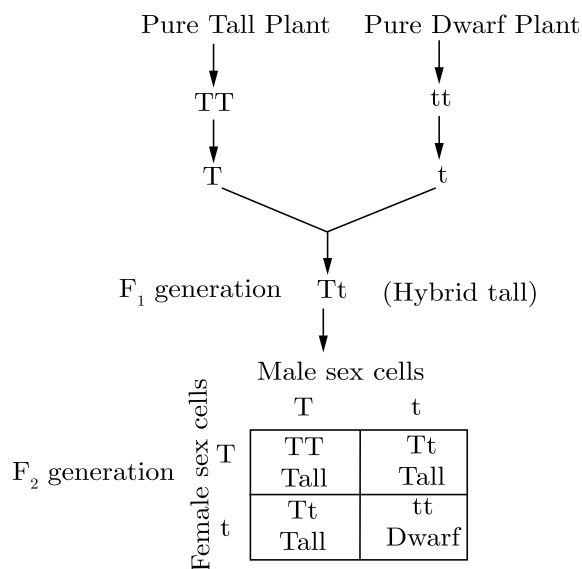
- 158.** (i) State Mendel's Law of Dominance.
 (ii) A pure tall plant (TT) is crossed with a pure dwarf plant (tt).
 Draw Punnett squares to show (1) F_1 generation (2) F_2 generation.
 (iii) Give the phenotype of the F_2 generation.
 (iv) Give the Phenotypic and Genotypic ratio of the F_1 and F_2 generation.
 (v) Name any one X-linked disease found in humans.

Ans :

SQP 2021

- (i) Law of Dominance : Out of a pair of contrasting characters present together, only one is able to express itself while the other remain unexpressed. The one that expresses itself is the dominant character and the one unexpressed is recessive.

(ii)



- (iii) Phenotypes of F_2 generation are both tall and dwarf.
 (iv) F_1 generation, all plants are tall with similar genotype Tt.
 F_2 generation phenotypic ratio is 3 tall : 1 dwarf.
 F_2 generation genotypic ratio is 1 TT : 2 Tt : 1 tt
 (v) Haemophilia, colourblindness.

- 159.** (i) State Mendel's law of Independent Assortment.
 (ii) A homozygous tall plant (T) bearing red coloured (R) flowers is crossed with a homozygous dwarf plant (t) bearing white

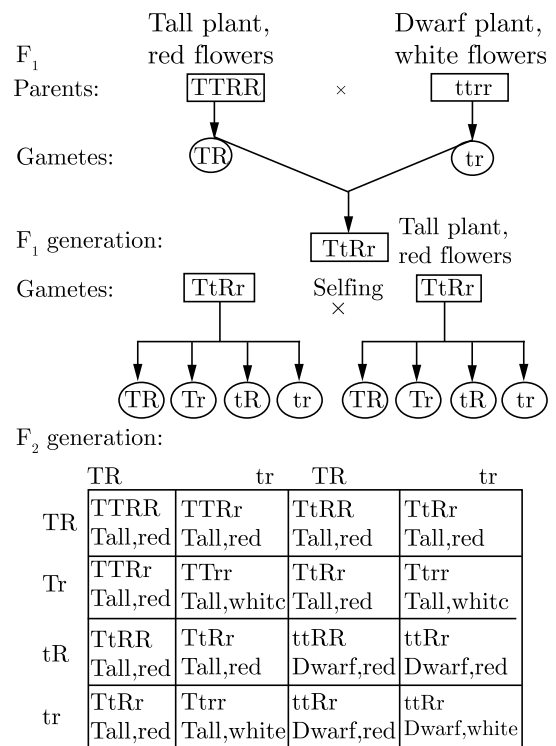
flowers (r):

- (a) Give the Genotype and Phenotype of the F_1 generation.
 (b) Give the possible combinations of the gametes that can be obtained from the F_1 hybrid.
 (c) Give the dihybrid ratio and the phenotype of the off-springs of the F_2 generation when two plants of the F_1 generation above are crossed.

Ans :

COMP 2015

- (i) When there are two pairs of contrasting characters, then the distribution of each pair to the gametes is independent of the distribution of the other pair of characters.
 (ii)



- (a) Genotype – TtRr (Heterozygous tall red).
 Phenotype – Tall plant, red flowers.
 (b) TR, Tr, tR and tr
 (c) Dihybrid ratio = 9 : 3 : 3 : 1
 Phenotype of the offsprings:
 Tall plant, red flowers = 9
 Tall plant, white flowers = 3
 Dwarf plant, red flowers = 3
 Dwarf plant, white flowers = 1

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CASE BASED QUESTION

160. In a biology class, the teacher explained how genetics plays a crucial role in determining the characteristics of living organisms. She discussed how traits like eye color, hair type, and even certain behaviors can be inherited from parents and passed down to offspring. The students were asked to observe similarities and differences in traits among family members and discuss how variations arise even within the same family.

1. How does genetics influence the transmission of traits from parents to offspring?
2. Why do variations in traits occur among family members, even when they share the same genetic material?
3. What role does heredity play in the development of physical features like eye color and hair type?
4. How can studying family traits help us understand the laws of heredity better?

Ans :

1. Genetics determines how traits are passed from parents to offspring through genes.
2. Variations occur due to genetic recombination and mutations, leading to differences even in the same family.
3. Heredity controls the transfer of traits like eye color and hair type through genes passed from parents.
4. Observing family traits helps us understand patterns of inheritance and how genes function in transmitting characteristics.

161. A genetic counselor is advising a couple where the husband has colorblindness, and the wife's father had the condition. The counselor explains that colorblindness is an X-linked recessive trait. Since the wife is not colorblind, she likely carries one normal gene and one abnormal gene. The couple wants to know the chances of passing colorblindness to their children.

1. Why is colorblindness more common in males than females?
2. How might the wife's genetic background affect their children's chances of inheriting colorblindness?
3. What is the likelihood of their sons inheriting colorblindness?
4. Why would a daughter be less likely to inherit colorblindness?

Ans :

1. Males are more affected because they have only one X chromosome, so the abnormal gene isn't masked.
2. The wife has a 50% chance of passing the abnormal gene to her children.
3. Sons have a 50% chance of inheriting colorblindness if they receive the abnormal X from their mother.
4. A daughter would need abnormal genes from both parents to inherit colorblindness.

162. Dr. Meera's genetics team studies mutations and their effects. They focus on gene mutations like sickle cell anemia and chromosomal mutations like Down's syndrome. They also use Ishihara cards to detect colorblindness and observe traits in hybrids like Hebras and Ligers from crossbreeding.

1. What is the difference between gene and chromosomal mutations?
2. How is colorblindness detected?
3. How do mutations cause diseases like sickle cell anemia and Down's syndrome?
4. How does crossbreeding affect hybrid traits?

Ans :

1. Gene mutations affect individual genes, while chromosomal mutations involve chromosome changes.
2. Colorblindness is detected using Ishihara cards.
3. Mutations alter DNA, leading to diseases like sickle cell anemia and Down's syndrome.
4. Crossbreeding results in hybrids with traits from both parents.

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163. Priya, a research student, is studying sex-linked inheritance. She learns that disorders like colorblindness and hemophilia are linked to the X chromosome and are more common in males. Additionally, she finds that traits like hypertrichosis (long hair on the pinna) are Y-linked, affecting only males.

1. Why are disorders like hemophilia more common in males than females?
2. What type of gene carries hypertrichosis, and who does it affect?
3. How does the presence of a single X chromosome influence sex-linked traits in males?
4. Name two X-linked disorders Priya studied in her research.

Ans :

1. Disorders like hemophilia are more common in males due to their single X chromosome.
2. Hypertrichosis is carried on the Y chromosome and affects only males.
3. A single X chromosome in males allows recessive traits to express more easily.
4. Priya studied colorblindness and hemophilia as X-linked disorders.

164. Arun is studying Mendelian inheritance in his biology class. He learns that traits are determined by alleles, with dominant alleles masking recessive ones. For example, brown eyes are dominant over blue eyes. Arun sets up an experiment with pea plants to observe the Law of Segregation and the Law of Dominance by crossing plants with different traits.

1. What does the Law of Dominance state about alleles in a heterozygous condition?
2. Which eye color is dominant, according to Arun's study?
3. What does the Law of Segregation explain about allele separation?
4. What is the observable outcome called in genetics?

Ans :

1. The Law of Dominance states that the dominant allele expresses itself in a heterozygous condition.
2. Brown eye color is dominant over blue, according to Arun's study.
3. The Law of Segregation explains that alleles separate independently during gamete formation.
4. The observable outcome in genetics is called the phenotype.

165. Nisha is studying genetic mutations and learns that mutations can affect a single gene or an entire chromosome. She examines examples like sickle cell anemia, caused by a gene mutation, and Down syndrome, resulting from a chromosomal mutation. Nisha notes how these mutations impact individuals differently based on their genetic structure.

1. What type of mutation causes sickle cell anemia?
2. Which syndrome is caused by a chromosomal mutation according to Nisha's study?
3. How do mutations impact an individual's genetic structure?
4. What can cause a change in a single gene or chromosome?

Ans :

1. Sickle cell anemia is caused by a gene mutation.
2. Down syndrome is caused by a chromosomal mutation.
3. Mutations alter an individual's genetic structure, affecting traits.
4. Chemical or structural changes can cause mutations in a gene or chromosome

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CHAPTER 3

ABSORPTION BY ROOTS

1. INTRODUCTION

Water is the major constituent of living beings. It is the medium in which all cellular reactions take place. It has physical properties such as high specific heat, high heat of vaporization, expansion upon freezing, cohesion and adhesion.

Roots absorb water and minerals from soil and help in ascent of sap (upward movement of water and dissolved minerals).

Water is the basic necessity of all life and plants specially need water as it helps in photosynthesis, transpiration, transportation, turgidity, cooling, opening of stomata and germination of seeds.

Mineral nutrients are essential for the growth and metabolic activities of plant cells. These are taken up by roots in the form of ions and radicals.

2. NEED OF MINERALS FOR PLANTS

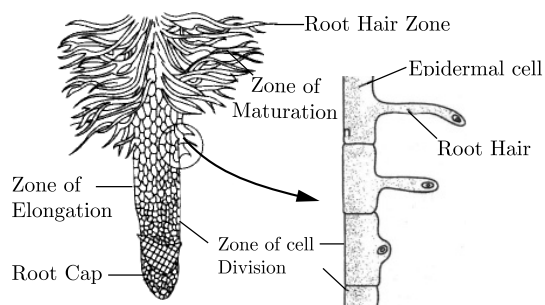
The following minerals are required for plants :

1. Magnesium – Essential for synthesis of chlorophyll.
2. Zinc – Essential for leaf formation.
3. Calcium – Maintains semi-permeability of cell membrane.
4. Potassium – Maintains osmotic balance of cell and controls opening and closing of stomata.
5. Phosphorus – Constituent of cell membrane and promotes cell division.
6. Manganese – Necessary for photolysis of water in photosynthesis.
7. Nitrogen – Required for protein synthesis and hence growth.

2.1 Characters of Roots for Absorbing Water

1. Extensive root hairs with rapid growth.
2. Enormous surface area.
3. High concentrated solution of root hairs because of the presence of a large vacuole filled with cell sap.
4. Thin walls of root hairs.

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Root and a part enlarged to show root hairs

3. IMBIBITION

It is the movement of water molecules into substances such as wood, seeds, agar or gelatin, which swell or increase in volume as a result of this movement. These substances are called imbibants.

Imbibition of water increases the volume of the imbibant due to which tremendous pressure is created which is known as imbibitional pressure.

4. DIFFUSION

It is the movement of molecules of various substances from the region of their higher concentration to the region of their lower concentration by random movement of the molecules or ions of the substance. This movement continues till the concentration of molecules become same in all available space. The force responsible for diffusion of molecules is their kinetic energy.

In a cell, diffusion spreads molecules and ions, throughout its protoplasm.

4.1 Diffusion Pressure

It is the pressure exerted by the diffusing particles and is directly proportional to their concentration. Higher the concentration of diffusing particles, greater is the diffusion pressure.

4.2 Rate of Diffusion

Though diffusion is a slow process, the rate of diffusion is faster if :

1. The difference in concentration between

the two regions (concentration gradient) is increased.

2. The distance between the two regions decreased.
3. The molecules diffusing are small and fat soluble.
4. The area over which diffusion occurs is increased.
5. The number of pores in the cell membrane is large and their size is greater.

4.3 Diffusion in Our Daily Life

When sugar is put in a liquid, its molecules diffuse throughout the liquid, giving it uniformly a sweet taste. The fragrance of perfume from an open bottle also reaches us through the process of diffusion.

4.4 Diffusion Observed in Plants

It helps in exchange of gases during photosynthesis and respiration. In transpiration, water vapours diffuse from the intercellular spaces to the outer atmosphere. During the passive salt uptake, ions are absorbed by the simple process of diffusion.

5. OSMOSIS

It is the movement of water molecules from the region of their higher concentration to the region of their lower concentration through a semipermeable membrane.

5.1 Osmotic Pressure

Osmotic pressure of a solution is that pressure which would be required to prevent it from gaining more solvent molecules if it is separated from the solvent by a differentially permeable membrane.

5.2 Types of Membranes

1. Permeable membrane, e.g. cell wall, muslin cloth.
2. Impermeable membrane, e.g. rubber sheet.
3. Semipermeable membrane, e.g. parchment paper, sheeps or goats bladder, cellophane paper, egg membrane, visking bag.
4. Differentially permeable membrane, e.g. cell membrane.

6. TONICITY

It is the amount of tension developed in a system on account of solute particles on it.

The solutions are of three types :

1. Isotonic solution
2. Hypotonic solution

3. Hypertonic solution

7. TURGIDITY

A cell when reaches a state where it cannot accommodate any more water (fully distended condition), when it is kept in a hypotonic solution is called turgidity and the state of the cell is called as turgid.

Turgidity of cells is essential for the plant to live and grow normally. It provides rigidity to plants such as stretching of shoots, keeping leaves erect and fully expanded.

Drooping of leaves on touching is brought by the changes in turgidity of the cells of pulvinus of *Mimosa pudica* (touch me not plant).

7.1 Turgor Pressure and Wall Pressure

The hydrostatic pressure developed inside a cell on the cell wall due to endosmosis is called turgor pressure and the pressure exerted by the cell wall on the cell content is called wall pressure.

Turgor pressure and wall pressure normally counter balance each other and a state of equilibrium is maintained.

8. PLASMOLYSIS

In plant cells, placed in hypertonic solution, water escapes from the vacuoles of the cell by exosmosis. First, the cell becomes flaccid, with further loss of water, the protoplast shrinks away from the cell wall, often assumes a spherical shape and ultimately comes to lie in the centre of the cell. The shrinkage of the cytoplasm along with the plasma membrane from the cell wall under the action of a hypertonic solution is called as plasmolysis.

8.1 Importance of Plasmolysis

It proves permeable nature of cell wall and semipermeable nature of plasma membrane. It also helps in determining the osmotic pressure of a cell and that whether a particular cell is living or dead.

High concentration of sugar in jams and jellies protect them from decay by bacteria and fungi due to plasmolysis.

9. DEPLASMOLYSIS

The phenomenon of absorption of water by a plasmolysed cell through endosmosis is called as deplasmolysis.

10. ROOT PRESSURE

It is the pressure developed in the xylem of roots due to inflow of water, which helps in pushing the plant sap upwards. Root pressure is built up due to cell to cell osmosis in the root tissue.

11. ASCENT OF SAP

The upward transport of water (along with dissolved inorganic mineral salts) from roots to aerial parts of the plant is called ascent of sap.

This process occurs in plants through xylem tissue which are continuous and forms an unbroken system of tubes. Ascent of sap is due to root pressure, cohesion, adhesion, transpiration pull and capillarity and force.

11.1 Path of Ascent of Sap

Soil water (with dissolved substances) → Root hairs → Epidermis → Cortex (cortical cells) → Endodermis → Pericycle → Xylem vessels.

12. TRANSPIRATION PULL

It is created due to transpiration of water through stomata. It is transmitted down to the root hairs. It pulls the water from a lower level to a higher level. The transpiration pull plays a very vital role in the ascent of sap in higher plants.

13. DIFFERENCES BETWEEN DIFFUSION AND OSMOSIS

Differences between diffusion and osmosis are as follows :

	Diffusion		Osmosis
1.	It is bi-directional.	1.	It is unidirectional.
2.	No membrane present.	2.	Two solutions are always separated by a semi-permeable membrane.
3.	Occurs in liquid as well as gaseous state.	3.	Occurs in liquid state only.
4.	It is not influenced by solute potential.	4.	It is dependent on solute potential.

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MULTIPLE CHOICE QUESTION

1. During a practical exam, a plant cell in a particular solution was placed under a compound microscope. Students were told to observe the cell and name the tonicity of the solution and mention the process that occurred in the cell.



- (a) Isotonic, Endosmosis
(b) Hypotonic, Active Transport
(c) Hypertonic, Endosmosis
(d) Hypertonic, Exosmosis

Ans :

SQP 2025

Thus (d) is correct option.

2. Osmosis takes place when there is:
(a) A freely permeable membrane
(b) A cell wall
(c) A selectively permeable membrane
(d) An impermeable membrane

Ans :

MAIN 2024

Osmosis is the movement of solvent molecules (usually water) across a selectively permeable membrane from an area of lower solute concentration to an area of higher solute concentration.

Thus (c) is correct option.

3. A plant cell may burst when :
(a) Turgor pressure equalises wall pressure.
(b) Turgor pressure exceeds wall pressure.
(c) Wall pressure exceeds turgor pressure.
(d) None of the above.

Ans :

MAIN 2016

A plant cell may burst when turgor pressure exceeds wall pressure.

Thus (b) is correct option.

4. Marine fish when placed in tap water bursts because of :

- (a) Endosmosis (b) Exosmosis
(c) Diffusion (d) Plasmolysis

Ans :

COMP 2017

Marine fish burst when thrown under tap water because of endosmosis, because its metabolism is different and it is adapted to live in water with a higher concentration of salt in their cells.

Thus (a) is correct option.

5. The pressure developed in the roots due to continuous inward movement of water by cell to cell osmosis :

- (a) Root pressure.
(b) Wall pressure.
(c) Turgor pressure.
(d) Air pressure.

Ans :

SQP 2021

Pressure developed in the roots due to continuous inward movement of water is the root pressure.

Thus (a) is correct option.

6. When a cell is placed in a _____ solution it becomes plasmolysed.

- (a) Distilled water.
(b) Hypertonic.
(c) Isotonic.
(d) Hypotonic.

Ans :

COMP 2021

When a cell is placed in the hypertonic solution, water moves from the cell to its outside. This results in shrinkage of the cytoplasm. This cell is called the plasmolysed cell. The cell usually becomes flaccid.

Thus (b) is correct option.

7. A shoot from a balsam plant is kept in a beaker containing eosin solution (pink). The pink colour will be distinctly seen in the :

- (a) Xylem (b) Phloem
(c) Epidermis (d) Cortex

Ans :

MAIN 2021

The xylem tissues are distinctly visible as they have taken the stain indicating that the solution moved through the xylem.

Thus (a) is correct option.

8. State the function of the following :

- (a) Cell wall : Regulates entry of solutes in plant cells.
(b) Regulates entry of solutes in animal cells.
(c) Gives rigidity and shape to plant cells.
(d) Gives rigidity and shape to animal cells.

Ans :

SQP 2021

Cell wall controls and regulates the direction of cell growth. Providing the strength, structural support and maintaining the shape of the cell. Functions as a storage unit by storing carbohydrates for use in plant growth, especially in seeds. It allows entry of smaller molecules through it freely.

Thus (c) is correct option.

9. Xylem tissue :

- (a) Conducts water and minerals in leaves.
(b) Does not conduct water and animals in stems.
(c) Conducts food and nutrients to roots.
(d) Conducts food and nutrients to all parts of the plant.

Ans :

COMP 2021

Xylem transports water, minerals, and nutrients from the soil to all the plant parts. There are two types of "transport" tissues in plants- xylem and phloem. Water and solutes are transported by the xylem from the roots to the leaves, and food is transported from the leaves to the rest of the plant by the phloem.

Thus (a) is correct option.

10. Marine fish when placed in tap water bursts because of :

- (a) Endosmosis (b) Exosmosis
(c) Diffusion (d) Plasmolysis

Ans :

MAIN 2017

Marine fish cannot thrive in the fresh water. The marine fish are accustomed to salt water, which contains a high concentration of solutes (salts), whereas freshwater is devoid of solutes. As a result, when a marine fish is immersed in freshwater, endosmosis causes the freshwater to diffuse into the cells (flow of solutes from an area of lesser concentration to one of greater concentration). They will grow and explode as a result of this.

Thus (a) is correct option.

11. A plant cell may burst when :

- (a) Turgor pressure equalises wall pressure
(b) Turgor pressure exceeds wall pressure
(c) Wall pressure exceeds turgor pressure
(d) None of the above

Ans :

COMP 2016

The turgor pressure is the amount of pressure that allows the cell to maintain its form. Endosmosis is the process through which water enters a cell. The turgor pressure rises as a result. The turgor pressure and the wall pressure are always equal. The cell wall will burst if the turgor pressure exceeds the wall pressure.

Thus (a) is correct option.

- 12.** Girdling of a tree results in the death of the tree due to:

- (a) Starvation of root
- (b) Starvation of shoot
- (c) No conduction
- (d) No upward conduction of food

Ans :

SQP 2020

Girdling results in the removal of the phloem and death occurs from the inability of the leaves to transport sugars (primarily sucrose) to the roots. In this process, the xylem is left untouched and the tree can usually still temporarily transport water and minerals from the roots to the leaves.

Thus (a) is correct option.

- 13.** The cell increases in volume if the external solution is:

- (a) Hypertonic
- (b) Hypotonic
- (c) Isotonic
- (d) Concentrated than cell sap

Ans :

MAIN 2010

The water molecules move into a cell when a cell is placed in a hypotonic medium (resulting in an increase in cell volume) and water moves out of the cell when a cell is placed in a hypertonic medium (resulting in a decrease in cell volume).

Thus (b) is correct option.

- 14.** Mineral salts are absorbed by roots from the soil in the form of:

- (a) Very dilute solution
- (b) Concentrated solution
- (c) Hypertonic solution
- (d) Very concentrated solution

Ans :

SQP 2023

Minerals are absorbed by plant roots from the soil solution. In the soil, minerals existing as positively charged ions are adsorbed on clay particles because clay particles are negatively charged. Some amounts of minerals are also

present dissolved in soil water as a very dilute solution. Hence, most of the minerals are actively absorbed by plant roots in addition to the direct exchange mechanism.

Thus (a) is correct option.

- 15.** Deplasmolysis in a cell occurs when it is placed in:
- (a) Isotonic solution
 - (b) Hypotonic solution
 - (c) Hypertonic solution
 - (d) None of these

Ans :

COMP 2011

When a plasmolysed cell is placed in a hypotonic solution, water moves into the cell because of the higher concentration of water outside the cell. The cell then swells and become turgid. This is called deplasmolysis.

Thus (b) is correct option.

- 16.** Transport of water in stem takes place through:

- (a) Phloem
- (b) Xylem
- (c) Epidermis
- (d) Endodermis

Ans :

MAIN 2008

Xylem is a specialized tissue in the form of a vascular bundle that transports water absorbed by the roots to the various parts of the plant. It also provides physical support.

Thus (b) is correct option.

- 17.** Transport of substances against the concentration gradient in a cell by using energy is:

- (a) Osmosis
- (b) Diffusion
- (c) Passive transport
- (d) Active transport

Ans :

SQP 2005

During active transport, substances move against the concentration gradient, from an area of low concentration to an area of high concentration. This process is “active” because it requires the use of energy (usually in the form of ATP).

Thus (d) is correct option.

- 18.** Drooping of leaves of Mimosa plant is due to:

- (a) Change in turgor pressure
- (b) Imbibition
- (c) Plasmolysis
- (d) Diffusion

Ans :

COMP 2000

When the Mimosa pudica, commonly known as the sensitive plant, is touched by another organism, its leaves fold in upon themselves and its stems droop. The leaves of the Mimosa achieve this rapid folding by a change in turgor pressure.

Thus (a) is correct option.

19. A root hair is:

- (a) Extension of cortical cell
- (b) Extension of epidermal cell
- (c) Specialised multicellular structure
- (d) Extension of endodermis

Ans :

SQP 2007

Root hairs are the extension of outer epidermal cells of the root. They contain large vacuoles having cell sap. Because of this property, water is drawn inside the root hair by a process of osmosis. Thus (b) is correct option.

20. Some liquid is collected from the xylem in the stem of a plant. What is present in the liquid?

- (a) Cellulose
- (b) Inorganic ions
- (c) Starch
- (d) Sugar

Ans :

MAIN 2003

The main function of xylem is to transport water, and some soluble nutrients including minerals and inorganic ions, upwards from the roots to the rest of the plant.

Thus (c) is correct option.

21. In which order does water pass through the cells of a plant, as the water travels from the roots to a leaf ?

- (a) Mesophyll cells → root hair → root cortex → xylem
- (b) Root cortex → root hair → xylem → mesophyll cells
- (c) Root hair → mesophyll cells → root cortex → xylem
- (d) Root hair → root cortex → xylem → mesophyll cells

Ans :

COMP 2015

When roots absorb water, it moves from root hair cells to the root cortex cells and then passes on through xylem to the leaf mesophyll cells from where it leaves the plant body and goes to the atmosphere in form of water vapour during transpiration.

Thus (b) is correct option.

22. On a dry, sunny day, how does water vapour move through the stomata of a leaf?

- (a) Into the leaf by diffusion
- (b) Into the leaf by respiration
- (c) Out of the leaf by diffusion
- (d) Out of the leaf by respiration

Ans :

SQP 2021

Water vapour pass outwardly through stomata by

diffusion

Thus (c) is correct option.

23. How do carbon dioxide and oxygen move into and out of a mesophyll cell?

- (a) Active transport
- (b) Diffusion
- (c) Respiration
- (d) Transpiration

Ans :

MAIN 2018

Exchange of gases (CO_2 and O_2) between the plant interior and outside air occurs through diffusion.

Thus (b) is correct option.

24. What are the important features of osmosis?

	Requires a partially permeable membrane	Diffusion is involved	Require cell walls
(a)	✓	✓	×
(b)	×	✓	×
(c)	✓	×	✓
(d)	×	×	✓

Ans :

COMP 2017

Osmosis is a process by which solvent molecules tend to pass through a semi-permeable membrane according to the concentration gradient of solvent molecules across the semi-permeable membrane.

Thus (a) is correct option.

25. Which characteristics are correct for both osmosis and diffusion?

	Requires a partially permeable membrane	Are energy consuming processes	Require a concentration gradient
(a)	✓	×	✓
(b)	✓	✓	×
(c)	×	×	✓
(d)	×	✓	×

Ans :

SQP 2014

Both diffusion and osmosis involve the movement of molecules/particles from higher concentration to lower concentration. Both are passive transport. Thus (c) is correct option.

26. Special anatomical structure through which guttation occurs are:

- (a) Hydathode
- (b) Stomata
- (c) Lenticel
- (d) Cuticle

Ans :

MAIN 2010

Hydathodes are the structures that discharge water from the interior of the leaf to its surface in a process called guttation.

Thus (a) is correct option.

- 27.** Osmosis is defined as the diffusion of water molecules

- (a) Down their concentration gradient through a permeable membrane.
- (b) Up their concentration gradient through a partially permeable membrane.
- (c) Up their concentration gradient through a permeable membrane,
- (d) Down their concentration gradient through a partially permeable membrane

Ans :

SQP 2017

During the process of osmosis, the water molecules moves down their concentration gradient, i.e., from the region of its high concentration to the region of its lower concentration through a partially permeable or semi-permeable membrane.

Thus (d) is correct option.

- 28.** Each one of the following contribute to the ascent of sap except for:

- (a) Wall pressure
- (b) Root Pressure
- (c) Capillarity
- (d) Adhesion

Ans :

MAIN 2000

Wall pressure does not contribute to the ascent of sap.

Thus (a) is correct option.

- 29.** Priya observes water droplets on leaves early in the morning and learns that this is guttation. She needs to identify the conditions under which guttation occurs. Plants lose water by guttation when:

- (a) Rate of transpiration is high
- (b) Soil is wet and the atmosphere is humid
- (c) Soil is dry and atmosphere is dry
- (d) Soil is wet and atmosphere is dry

Ans :

MAIN 2001

The process by which plants loose water in liquid form is called guttation. This process can usually be witnessed in plants in early morning and at night, mostly in herbaceous plants growing in high humidity conditions and high moisture of soil. Guttation water contain many dissolved minerals.

Thus (b) is correct option.

- 30.** Which is an example of active transport?

- (a) Carbon dioxide entering a leaf
- (b) Oxygen moving from the alveoli into the blood
- (c) Ion uptake by root hair cells
- (d) Water uptake by root hair cells

Ans :

MAIN 2014

Nutrients such as ions of nitrates, sulphates, potassium, zinc, manganese, etc., cannot pass through the cell membrane of the root cells easily. This is because their concentration is higher inside the root cells. Therefore active transport takes place.

Thus (c) is correct option.

- 31.** Match the items in column I with those which are most appropriate in column II and choose the correct option.

	Column I		Column II
A.	Turgid	(i)	intake of mineral salts
B.	Diffusion	(ii)	a cell charged with water
C.	Active transport	(iii)	limiting membrane of a vacuole
D.	Osmosis	(iv)	movement of particles from higher to lower concentration
E.	Tonoplast	(v)	movement of solvent across semi-permeable membrane

- (a) A-(ii), B-(iv), C-(i), D-(v), E-(iii)
- (b) A-(iii), B-(iv), C-(i), D-(v), E-(ii)
- (c) A-(i), B-(iv), C-(ii), D-(v), E-(iii)
- (d) A-(ii), B-(v), c-(i), D-(iv), E-(iii)

Ans :

SQP 2017

A cell charged with water refers to a turgid cell. Diffusion is the process of movement of particles from higher to lower concentration. Active transport is the intake of mineral salts. Osmosis is the movement of solvent across a semi-permeable membrane. Tonoplast is a limiting membrane which bounds the chief vacuole of a plant cell.

Thus (a) is correct option.

- 32.** Water forms a very important constituent of the of the cell.

- (a) Nucleus
- (b) Cytoplasm
- (c) Protoplasm
- (d) Nucleoplasm

Ans :

COMP 2020

Water forms a very important constituent of the protoplasm of the cell. Water constitutes about 65% to 80% of the protoplasm. In protoplasm, water is present in both bound as well as free form. Free form of water provides medium for all the biochemical reactions occurring in a cell. Bound water remains loosely linked with protein molecules by hydrogen bonds or other forces. Thus (c) is correct option.

33. Which structures must be present in a cell for osmosis to take place?

(a) Cell (sap) vacuole and cell wall
(b) Cell wall and cell membrane
(c) Chloroplast and cytoplasm
(d) Cytoplasm and cell membrane

Ans :

SQP 2002

In order to function, cells are required to move materials in and out of their cytoplasm via their cell membranes. Therefore cytoplasm and cell membrane is an important requirement. Thus (c) is correct option.

34. gives cooling effect in plants.

(a) Transpiration (b) Evaporation
(c) Translocation (d) Transportation

Ans :

SQP 2002

Rapid loss of water in the form of water vapour from the aerial parts of the plant through transpiration brings down the temperature in plants. Transpiration thus provides a significant cooling effect which keeps the plant from being over heated.

Thus (a) is correct option.

35. In the process of, water is used up in the green leaves as a raw material in the synthesis of glucose.

(a) Translocation
(b) Absorption
(c) Transpiration
(d) Photosynthesis

Ans :

MAIN 2013

The raw materials for the photosynthesis are water, carbon dioxide and sunlight. Thus (d) is correct option.

36. Root hairs contain

(a) Salt (b) water
(c) Cell sap (d) Minerals

Ans :

SQP 2004

Root hairs are the extensions of outer epidermal cells of the root. They contain large vacuoles which is full of cell sap. The cell sap has a greater concentration of salts as compared to the surrounding sub-soil water. Because of this property, water is drawn inside the root hair by a process of osmosis.

Thus (c) is correct option.

37. takes place when the surrounding solution is more concentrated.

(a) Osmosis
(b) Diffusion
(c) Endosmosis
(d) Exosmosis

Ans :

MAIN 2017

Exosmosis is the outward diffusion of water through a semi-permeable membrane when the surrounding solution is more concentrated.

Thus (d) is correct option.

38. Cell wall is

(a) Semi-permeable
(b) Selectively permeable
(c) Impermeable
(d) Freely permeable

Ans :

SQP 2009

The cell wall is freely permeable as it allows the free exchange of water and nutrients between the cells and outer environment.

Thus (d) is correct option.

39. is the relative concentration of solutes dissolved in solution which determine the direction and extent of diffusion.

(a) Turgidity (b) Tonicity
(c) Plasmolysis (d) Rigidity

Ans :

MAIN 2004

Tonicity is the relative concentration of the solutions that determine the direction and the extent of diffusion. Based on tonicity the solutions are of three types: hypertonic solution, isotonic solution and hypotonic solution.

Thus (b) is correct option.

40. If a cell is kept in hypotonic solution, ... Occurs.

(a) No osmosis (b) Exosmosis
(c) Endosmosis (d) Osmosis

Ans :

SQP 2021

If a plant cell is kept in a hypotonic solution then the plant cell gains water or endosmosis occurs and becomes turgid.

Thus (c) is correct option.

41. is the pressure exerted by all contents on the cell wall.

(a) Osmotic pressure (b) Turgor pressure
(c) Wall pressure (d) All of the above

Ans :

MAIN 2016

Turgor pressure is the force within the cell that pushes the plasma membrane against the cell wall. It is also called hydrostatic pressure. Turgor is what makes living plant tissue rigid.

Thus (b) is correct option.

42. occurs through semi-permeable membrane.

(a) Osmosis (b) Diffusion
(c) Imbibition (d) Transportation

Ans :

COMP 2006

Osmosis is a process by which solvent molecules tend to pass through a semi-permeable membrane according to the concentration gradient of solvent molecules across the semi-permeable membrane.

Thus (a) is correct option.

43. Flaccidity is the reverse of

(a) Turgidity (b) Plasmolysis
(c) Deplasmolysis (d) Both a and c

Ans :

MAIN 2010

Flaccidity is the reverse of turgidity, the cell content is shrunk and the cell is not tighter. In deplasmolysis also the cell achieves turgid state.

Thus (d) is correct option.

44. is the result of inward movement of water molecules.

(a) Plasmolysis
(b) Flaccidity
(c) Deplasmolysis
(d) Both b and c

Ans :

SQP 2003

Plasmolysis is the process in which the cells lose water in a hypertonic solution. The reverse process of plasmolysis is deplasmolysis, which occurs when the cell is in a hypotonic solution and results in a lower external osmotic pressure and a net flow of water into the cell.

Thus (c) is correct option.

45. Reverse of plasmolysis occurs when the cell is kept in.

(a) Pond water (b) 10% sugar solution
(c) 5% salt solution (d) Pure water

Ans :

MAIN 2016

Plasmolysis can be reversed if the cell is placed in a hypotonic solution. When a plasmolysed cell is placed in a hypotonic solution such as pure water, (i.e., the solution having solute concentration lower than the cell sap), the water moves into the cell because of the higher concentration of water outside the cell than in the cell. The cell then swells to become turgid. It is called deplasmolysis. Thus (d) is correct option.

46. No net flow occurs when a cell is kept in

(a) Hypotonic solution (b) Hypertonic solution
(c) 5% sugar solution (d) Isotonic solution

Ans :

SQP 2020

If a cell is placed in an isotonic solution, there will be no net flow of water into or out of the cell and the cell's volume will remain stable.

Thus (d) is correct option.

47. Loss of water (cell sap) through a cut stem is called

(a) Bleeding (b) Guttation
(c) Transpiration (d) Injury

Ans :

COMP 2000

The exudation of water and cell sap through the cuts or wound of plants is called as bleeding.

Thus (a) is correct option.

48. Cell slightly enlarges or bursts when kept in.

(a) Hypertonic solution (b) Hypotonic solution
(c) Isotonic solution (d) Pond water

Ans :

SQP 2011

A hypotonic solution means a solution having a lower osmotic pressure as compared to another solution. So if a plant cell is kept in a hypotonic solution, then water will flow from the solution into the plant cell through the cell membrane and cell will swell up due to the uptake of water.

Thus (b) is correct option.

49. Salting of meat or addition of salt to pickles is a method of preservation by

(a) Osmosis (b) Exosmosis
(c) Plasmolysis (d) Deplasmolysis

Ans :

COMP 2015

All living walled cells plasmolyse when kept in a hypertonic solution. Pickels, meat and fish are preserved by salting. Salting create hypertonic condition in which the fungi and bacteria get killed by plasmolysis.

Thus (c) is correct option.

50. Which one of the following is not the example of semi-permeable membrane?

(a) Cellophane paper (b) Egg membrane
(c) Animal bladder (d) Rubber sheet

Ans :

SQP 2003

Cell membrane or plasma membranes of plant cells and animal cells, egg's membrane, Goat's bladder membrane are the natural substances which act as semi-permeable membrane. Cellophane paper, Parchment paper, Visking bag are the substances which act as semi-permeable membrane and are artificial in nature. Rubber sheet is an impermeable membrane.

Thus (d) is correct option.

51. The concentration gradient of the ions in active transport is opposite to that of

(a) Osmosis
(b) Diffusion
(c) Imbibition
(d) All of the above

Ans :

COMP 2007

During active transport, molecules move from an area of low concentration to an area of high concentration. This is the opposite of diffusion and these molecules are said to flow against their concentration gradient. Active transport is called 'active' because this type of transport requires energy to move molecules.

Thus (b) is correct option.

52. of a solution is a measure of its tendency to take in water by osmosis.

(a) Turgor pressure
(b) Wall pressure
(c) Osmotic pressure
(d) Root pressure

Ans :

SQP 2000

Osmotic pressure is the minimum pressure which needs to be applied to a solution to prevent the inward flow of its pure solvent across a semi-permeable membrane. It is also defined as the measure of the tendency of a solution to take in a pure solvent by osmosis.

Thus (c) is correct option.

53. is a phenomenon by which the living or dead plant cells absorb water by surface attraction.

(a) Imbibition (b) Diffusion
(c) Absorption (d) Transportation

Ans :

MAIN 2015

Imbibition is a phenomenon by which the dry surface of the living or dead plant cells absorb water by surface attraction. During the process of imbibition, water is absorbed by the solid particles called colloids, causing an enormous increase in volume.

Thus (a) is correct option.

54. pressure causes rupturing of seed coat in case of germination.

(a) Wall (b) Osmotic
(c) Root (d) Imbibition

Ans :

COMP 2013

During the beginning stage of the germination, the seeds take up water rapidly and this results in swelling and softening of the seed coat at an optimum temperature. The process of absorption of water is called imbibition. This absorption of water creates a massive imbibitional pressure which causes rupturing of seed coat which helps radicle and plumule to come in contact with the outer environment and they start growing into a new plant.

Thus (d) is correct option.

55. The leaves get wilted and droop down if

(a) Phloem is removed
(b) Cambium is removed
(c) Xylem is removed
(d) Both a and b

Ans :

SQP 2008

Xylem transports water and minerals in plants from roots up to the stem, to the leaves. If Xylem is removed from a plant, the plant will not be able to transport water to leaves which will hinder, hindering various processes like photosynthesis, transpiration, growth etc. The plant will initially wilt and then ultimately die.

Thus (c) is correct option.

56. Turgor pressure helps in the opening and closing of

(a) Lenticels (b) Cuticle
(c) Stomata (d) All of the above

Ans :

MAIN 2010

The turgor pressure, which is caused by the osmotic flow of water in the guard cells, controls the opening and closing of stomata. When the guard cells become turgid, they expand, causing stomata to open. Guard cells become flaccid as they lose water, causing stomatal closure.

Thus (c) is correct option.

57. Root pressure is built up due to cell-to-cell
 (a) Imbibition (b) Osmosis
 (c) Diffusion (d) Absorption

Ans :

COMP 2001

Root pressure is the transverse osmotic pressure within the cells of a root system that causes sap to rise through a plant stem to the leaves. Water then diffuses from the soil into the root xylem due to osmosis. Root pressure is caused by this accumulation of water in the xylem pushing on the rigid cells.

Thus (b) is correct option.

58. Drops of water along the leaf margin are due to excessive
 (a) Transpiration (b) Root Pressure
 (c) Osmotic Pressure (d) Wall Pressure

Ans :

SQP 2019

In the morning, drops of water appear on margins of leaves due to root pressure and this process is called as guttation. High root pressure forces the water all the way through stem and it comes out through the end of leaf veins. Thus, guttation can be defined as the process by which drops of water appear along leaf margins due to excessive root pressure.

Thus (b) is correct option.

59. Movement of molecules of a substance from their region of higher concentration to lower concentration when they are in direct contact.
 (a) Diffusion (b) Endosmosis
 (c) Imbibition (d) Active transport

Ans :

COMP 2015

Diffusion is the movement of molecules of a substance from their region of higher concentration to lower concentration when they are in direct contact. This movement occurs as a result of the random and constant motion characteristic of all molecules, atoms, or ions (due to kinetic energy) and is independent from the motion of other molecules.

Thus (a) is correct option.

60. The removal of water in the form of water droplets along the margins of the leaf is called
 (a) Bleeding
 (b) Guttation
 (c) Transpiration
 (d) Evaporation

Ans :

SQP 2001

The loss or excretion of water in the form of liquid droplets from the leaves and other parts of uninjured or intact plant is called guttation. Guttation takes place through special structures called hydathodes. They are usually found on the margins and tips of the leaves.

Thus (b) is correct option.

61. Guttation mainly occurs during
 (a) Hot weather
 (b) Dry weather
 (c) Windy day
 (d) Warm humid weather

Ans :

MAIN 2007

Guttation usually occurs during dry weather when transpiration rate is very low as compared to rate of water absorption. Due to this root pressure is developed and water is pushed out through specialized pores at vein endings called hydathodes. Each hydathode is made up of group of loosely arranged achlorophyllous or colourless and parenchymatous cells called epithem. These cells help in absorbing a good percentage of inorganic and organic solutes present in the exudate. Thus, guttation is due to the positive pressure in the xylem developed due to the root pressure.

Thus (b) is correct option.

62. The state of a cell in which the cell wall is rigid and stretched by the increase in volume due to the absorption of water is called:
 (a) Flaccidity
 (b) Turgidity
 (c) Capillarity
 (d) Tonicity

Ans :

COMP 2015

The state of a cell in which the cell wall is rigid and stretched by the increase in volume due to the absorption of water is called turgidity. Turgidity is essential in plant cells to make them keep standing upright.

Thus (b) is correct option.

63. Osmosis and Diffusion are the same except that in Osmosis there is:

- (a) A free permeable membrane.
- (b) A cell wall in between.
- (c) A selective permeable membrane in between.
- (d) An endless inflow of water into a cell

Ans :

SQP 2001

Diffusion is the free movement of molecules of a substance from their region of higher concentration to their region of lower concentration when the two are in a direct contact but in case of osmosis the same movement occurs but the two are separated by a selectively permeable membrane called as the semi-permeable membrane.

Thus (c) is correct option.

64. The space between the cell wall and plasma membrane in a plasmolysed cell is filled with:

- (a) Isotonic solution (b) Hypotonic solution
- (c) Hypertonic solution (d) Water

Ans :

MAIN 2006

The space between the cell wall and plasma membrane in a plasmolysed cell is filled with hypertonic solution. This is because the cell wall of plant is fully permeable and it cannot control the entry or exit of molecules of a substance. When this plant cell is placed in a hypertonic solution, it will lose water by exosmosis due to which the protoplasm of plant cell will shrink and will move inwards and away from the cell wall. This process is called as plasmolysis. As a result of plasmolysis, the hypertonic solution will occupy the space between the cell wall and plasma membrane in a plasmolysed cell.

Thus (c) is correct option.

65. Which of the following takes place in active transport?

- (a) Movement of a substance from its higher to lower concentration
- (b) Movement of water from its lower to higher concentration
- (c) Movement of water from its higher to lower concentration
- (d) Movement of a substance from its lower to higher concentration

Ans :

SQP 2018

Active transport is the movement of a substance (salt or ion) from its higher concentration to lower concentration through a living cell membrane against a gradient with the use of external energy

which is supplied by the cell in the form of ATP. Thus (d) is correct option.

66. Active transport

- (a) Passage of water from its lower to higher concentration through a cell membrane without any expenditure of energy.
- (b) Passage of ions from its lower to higher concentration through a cell membrane without any expenditure of energy.
- (c) Passage of water from its lower to higher concentration through a cell membrane using energy from the cell.
- (d) Passage of ions from its lower to higher concentration through a cell membrane using energy from the cell.

Ans :

MAIN 2002

Active transport is the passage of ions from its lower to higher concentration through a cell membrane using energy which is supplied by the cell in the form of ATP.

Thus (d) is correct option.

67. Guttation

- (a) The loss of water in the form of water droplets from the surface of the leaf.
- (b) The loss of water in the form of water droplets through the stomata.
- (c) The loss of water in the form of water droplets along the leaf margin.
- (d) The loss of water in the form of water vapour along the leaf margin.

Ans :

SQP 2008

Guttation is the loss of water in the form of water droplets from hydathodes (small pores present on the leaf margin) along the leaf margin of a small herbaceous plant. This process occurs especially in the early mornings.

Thus (c) is correct option.

68. Ascent of sap

- (a) Upward movement of ions from the root hair to aerial parts of the plant body.
- (b) Upward movement of water along with the minerals from the root to aerial parts of the plant body.
- (c) Upward movement of solution from the root to aerial parts of the plant body by the process of diffusion.
- (d) Upward movement of solute from the root to aerial parts of the plant body by the process of osmosis through semi-permeable membrane.

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Ans :

MAIN 2012

The upward movement of water and dissolved mineral salts from roots upwards to the leaves and other aerial parts is called Ascent of Sap. It is called the sap as it contains many dissolved minerals. The root pressure and transpiration pull helps in the conduction of water upwards to the leaves and other aerial parts of the plant through xylem.

Thus (b) is correct option.

69. Osmosis

- (a) Movement of water molecules from their lower concentration to their higher concentration through a semi permeable membrane.
- (b) Movement of solutes from their lower concentration to their higher concentration through a semi permeable membrane.
- (c) Movement of water molecules their higher concentration to their lower concentration through a semi-permeable membrane.
- (d) Movement of water molecules from their higher concentration to their lower concentration through a freely permeable membrane.

Ans :

SQP 2020

In osmosis, the movement of water through a semipermeable membrane occur according to the concentration gradient of water across the membrane, which is inversely proportional to the concentration of solutes which means that in osmosis, the movement of water molecules takes place from their higher concentration (dilute solution or with a lower solute concentration) to their lower concentration (concentrated solution or with a higher solute concentration) through a semi-permeable membrane.

Thus (c) is correct option.

70. Tonicity

- (a) Relative concentration of the solute that determine the direction and the extent of osmosis
- (b) Relative concentration of the solute and solvent that determine the direction and the extent of diffusion.
- (c) Relative concentration of the solutions that determine the direction and the extent of diffusion.
- (d) Relative concentration of the solute and solvent that determine the direction and the extent of osmosis.

Ans :

SQP 2019

Tonicity is the relative concentration of the solutions that determine the direction and the extent of diffusion. Based on tonicity the three types of solutions are: isotonic, hypotonic and hypertonic solution.

Thus (c) is correct option.

71. Hydathode

- (a) Helps in transpiration
- (b) Helps in guttation
- (c) Helps in imbibition
- (d) Helps in transportation of water

Ans :

MAIN 2022

Hydathodes are small pores found in the epidermis of the leaves of certain plants. They are used by the plant to secrete water under conditions in which transpiration is inhibited, for example, when the atmosphere is very humid, the water is lost from the margins of the leaf in the form of water droplets. This process of water loss is called guttation.

Thus (b) is correct option.

72. Phloem

- (a) Helps in transportation of food
- (b) Helps in transportation of water
- (c) Helps in transportation of mineral
- (d) Helps in transportation of air

Ans :

SQP 2023

Phloem tissues in plants is composed of various specialized cells such as sieve tubes, companion cells, phloem fibres, and phloem parenchyma cells. Its main function is the conduction of food made in the leaves to all other parts of the plant.

Thus (a) is correct option.

73. Semi-permeable membrane

- (a) Allows free movement of only ions through it.
- (b) Allows free movement of molecules or ions through it
- (c) Allows certain molecules or ions to pass through it.
- (d) Allows movement of water through it.

Ans :

COMP 2004

Semi-permeable membrane is a selectively permeable cell membrane that allows the movement of certain molecules or ions through it by means of active or passive transport.

Thus (c) is correct option.

74. Root hairs

- (a) Absorption of ions and minerals from the soil.
- (b) Absorption of water and minerals from the soil.
- (c) Absorption of oxygen and minerals from the soil.
- (d) Absorption of gases and minerals from the soil.

Ans :

MAIN 2008

Root hairs are the extension of outer epidermal cells of the root. They help in the absorption of water and minerals from the soil. Apart from that, they provide anchoring to the plant and store food.

Thus (b) is correct option.

75. Xylem

- (a) Translocation of food from the leaves to the other parts of the plant.
- (b) Conduction of food.
- (c) Conduction of water and food.
- (d) Conduction of water and minerals from the root to the other parts of the plant.

Ans :

SQP 2019

Xylem is a specialised tissue of vascular plant and its main function is Conduction of water and minerals from the root to the other parts of the plant.

Thus (d) is correct option.

76. Root hair

- (a) Extension of the cortex
- (b) Extension of epithelium
- (c) Extension of epidermis
- (d) Extension of endodermis

Ans :

MAIN 2010

Root hairs are the extensions of the outer epidermal cells of the root. They contain large vacuole which is filled with cell sap. This cell sap has some salts dissolved in it and therefore it has greater concentration as compared to the surrounding sub-soil water.

Thus (c) is correct option.

77. Xylem

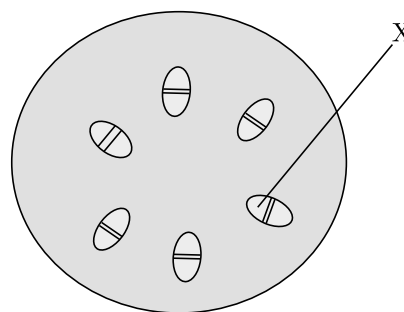
- (a) Centre of the vascular bundle.
- (b) Outer side of the vascular bundle.
- (c) On the margins of leaves
- (d) On the margins of roots.

Ans :

COMP 2007

Xylem is located in the centre of the vascular bundle, deep in the plant. Their movement is unidirectional and it transports water and minerals from roots to other aerial parts of the plant.

Thus (c) is correct option.

78. The diagram shows a cross-section through a plant stem.

X shows the part that is stained red when the stem is placed in water containing a red dye. What is found at X?

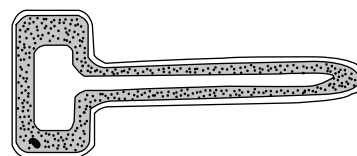
- (a) Guard cells
- (b) Palisade cells
- (c) Xylem
- (d) Phloem

Ans :

SQP 2016

The vascular bundles are arranged near the edge of the stem, with the phloem on the outside and the xylem on the inside.

Thus (c) is correct option.

79. The diagram shows the structure of a plant cell. What is a function of this specialised plant cell?

- (a) It absorbs carbon dioxide from the air.
- (b) It absorbs ions from the soil.
- (c) It transports sucrose from leaves.
- (d) It transports water in stems.

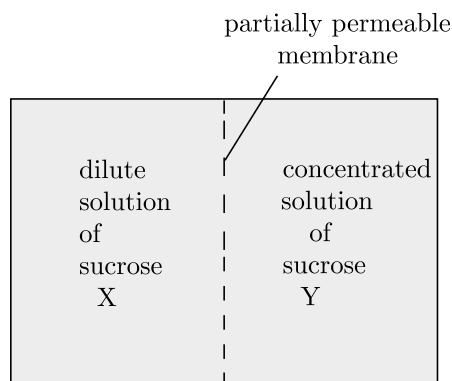
Ans :

MAIN 2010

Plants absorb water from the soil by osmosis. They absorb mineral ions by active transport, against the concentration gradient. Root hair cells are adapted for taking up water and mineral ions by having a large surface area to increase the rate of absorption.

Thus (b) is correct option.

80. The diagram shows two solutions that are separated by a partially permeable membrane.



In which direction will most water molecules move in relation to their concentration gradient?

- From X to Y against their concentration gradient.
- From Y to X against their concentration gradient.
- From Y to X down their concentration gradient.
- From X to Y down their concentration gradient.

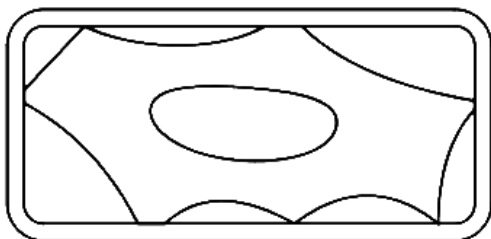
Ans :

MAIN 2013

Since more free water molecules are present on the side of dilute solution X, more of them will pass to enter the solution Y.

Thus (d) is correct option.

81. The diagram shows a plant cell after it has been submerged in a solution, for 15 minutes.



Which option describes the tonicity of solution P and the condition of the cell?

- Solution P is hypertonic than the cell sap and the cell is plasmolysed and turgid.
- Solution P is hypotonic than the cell sap and the cell is plasmolysed and turgid.
- Solution P is hypertonic than the cell sap and the cell is plasmolysed and flaccid.
- Solution P is hypotonic than the cell sap and the cell is plasmolysed and flaccid.

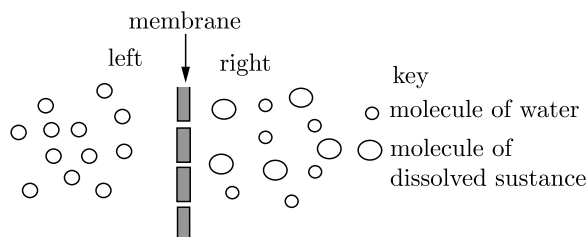
Ans :

MAIN 2005

The above plant cell shows a plasmolysed state which occurs when it is kept in a hypertonic solution or a solution whose water potential is less than that of the cell sap. Due to exosmosis there is shrinkage of protoplast or the cell becomes flaccid.

Thus (c) is correct option.

82. The diagram represents two liquids, separated by a membrane through which osmosis can occur.



What movement of molecules will occur?

- Molecules of dissolved substance move from left to right.
- Molecules of dissolved substance move from right to left.
- Overall, water molecules move from left to right.
- Overall, water molecules move from right to left.

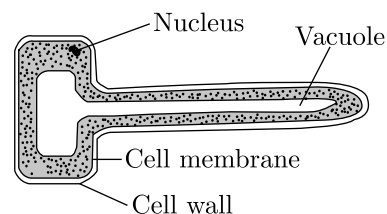
Ans :

COMP 2019

Osmosis is a process of movement of solvents through a semipermeable membrane from a region of lower solute concentration to higher solute concentration. In this case, water will move from left to right.

Thus (c) is correct option.

83. The diagram shows a specialized cell.



For which function is the cell adapted?

For which function is the cell adapted?

- Absorption of water
- Contraction of muscles
- Movement of dust particles
- Transport of oxygen

Ans :

MAIN 2016

The function of the root hair cell is to obtain water from the ground and transport this to the Xylem. Plants absorb water from the soil by osmosis. Root hair cells are adapted for this by having a large surface area to speed up osmosis. This speeds up the movement of water by osmosis. Thus (a) is correct option.

84. Phloem

- (a) Between the lower and upper epidermis.
- (b) Outer side of the vascular bundle.
- (c) On the lower epidermis of leaves
- (d) Deep in the plant

Ans :

MAIN 2014

Phloem is located on the outer side of the vascular bundle. Their movement is bidirectional and it helps in the transport of food from roots to other aerial parts of the plant.

Thus (b) is correct option.

ASSERTION AND REASON

85. Assertion : A special type of diffusion of water through a semi-permeable membrane is known as osmosis.

Reason : The net direction of osmosis depends on the pressure gradient.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

SQP 2007

Osmosis is diffusion of water from its pure state (or dilute solution) into a solution (or stronger solution) when the two are separated by a semi-permeable membrane. The difference in the water potentials of solutions separated by a semi-permeable membrane determine the net direction. Thus (c) is correct option.

86. Assertion (A) : Most minerals must enter the root by active absorption into the cytoplasm of epidermal cells.

Reason (R) : This transportation needs energy in the form of ATP. Some ions also move into the epidermal cells passively.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

SQP 2003

Most minerals enter the root by active absorption into the cytoplasm of epidermal cells. This transportation needs energy in the form of ATP, some ions also move into the epidermal cells passively.

Thus (a) is correct option.

87. Assertion : Mineral nutrients are an essential constituent of the cell and help to synthesis many compounds or enzymes in the cell.

Reason : The absorption of minerals from the soil is done by the roots only.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

MAIN 2007

Mineral nutrients are an essential constituent of the cell. The mineral concentration within the soil is very low, therefore, it is dissolved in water and move around the soil in solution. Plants absorb the minerals from the soil with the help of root hairs.

Thus (b) is correct option.

88. Assertion : In hypertonic solution, a plant cell shrinks.

Reason : Due to plasmolysis in hypertonic solution, water moves out of the cells.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

MAIN 2017

In a hypertonic solution, when the cell is placed water moves out; it is first lost from the cytoplasm and then from the vacuole. When water is drawn

out of the cell into the extracellular (outside cell) fluid, it causes the protoplast to shrink away from the walls. The cell is said to be plasmolysed. Thus (a) is correct option.

- 89. Assertion :** In the turgid state, the cell is balanced i.e. no water enters or leaves it.

Reason : The turgor pressure and the wall pressure balance each other and no absorption of water occurs.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

COMP 2020

Turgor pressure (TP) is the pressure exerted by protoplasm on the wall and wall pressure (WP) is the pressure exerted by the wall on to the protoplasm. If TP is equal to WP it means that there is no net movement of water into the cell and cell is fully turgid.

Thus (a) is correct option.

- 90. Assertion :** Imbibition involves the absorption of water molecules by living or dead plant cells through their hydrophilic surfaces.

Reason : When seeds germinate, the seed coat breaks due to the imbibition pressure.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

SQP 2009

Imbibition is the absorption of water by living, or dead plant cells by surface attraction e.g., absorption of water by seeds.

Thus (b) is correct option.

- 91. Assertion :** Plants absorb water mostly by roots.

Reason : Root cap region participates actively in water absorption.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) If assertion is true but reason is false.

(d) If both assertion and reason are false.

Ans :

COMP 2014

Plants have the potential to absorb water through their entire surface right from root, stem, leaves, flowers, etc. However, as water is available mostly in the soil, only the underground root system is specialized to absorb water. In roots, the most efficient region of water absorption is the root hair zone. The root cap has the functions of protecting the delicate stem cells within the root tip.

Thus (c) is correct option.

ONE MARK QUESTIONS

DIRECTION : Name the following :

1. Expand the abbreviation-NADP.

Ans :

MAIN 2024

NADP stands for Nicotinamide Adenine Dinucleotide Phosphate.

2. Unicellular outgrowths from the epidermis of mofs.

Ans :

MAIN 2024

Root hairs

3. The tissue that transports manufactured starch from the leaves to all parts of plants.

Ans :

MAIN 2004

Phloem

4. The tissue responsible for the ascent of sap in plants.

Ans :

SQP 2003

Xylem

5. The pressure responsible for the movement of water molecules across the cortical cells of the root.

Ans :

COMP 2003

Turgor/root pressure

6. Condition of a cell placed in hypotonic solution.

Ans :

MAIN 2002

Turgid

7. The process by which water enters the root hair cell.

Ans : COMP 2001
Osmosis

8. The pressure exerted by cell contents on a plant cell wall.

Ans : SQP 2000
Turgor pressure

9. Tissue concerned with upward conduction of water in plants.

Ans : MAIN 2000, 1997
Xylem

10. Condition of cell in which the cell contents are shrunken.

Ans : SQP 2009, 1997
Plasmolysed/flaccid

11. The inward movement of solvent molecules through the plasma membrane of a cell.

Ans : COMP 2005, 1997
Endosmosis

12. The process by which raisins swell up when placed in a beaker of water.

Ans : MAIN 2010, 1996
Endosmosis

13. Movement of molecules from a region of high concentration to a region of low concentration.

Ans : SQP 2009
Diffusion

14. The process by which root hairs absorb water from the soil.

Ans : COMP 2017
Osmosis

15. The process of uptake of mineral against the concentration gradient using energy cell.

Ans : MAIN 2015
Active transport

16. The phenomenon by which living or dead plant cells absorb water by surface attraction.

Ans : SQP 2012

Imbibition

17. The instrument used to measure root pressure.

Ans : MAIN 2020
Manometer

18. One factor that affect water potential in plant.

Ans : COMP 2023
Number of moles of the substance present at atmospheric pressure.

19. Name the terms used in reference to concentration between two solutions.

Ans : SQP 2021
Tonocity

20. Shrinkage of protoplasm when a cell is kept in a hypertonic solution.

Ans : MAIN 2016
Plasmolysis

21. The process in which water absorption needs metabolic energy.

Ans : COMP 2015
Active absorption

22. The tissue which conducts water and minerals from the root to the other parts of the plant.

Ans : COMP 2021
Xylem

23. Movement of water out of a cell when it is kept in a hypertonic solution.

Ans : SQP 2001
Exosmosis

24. A cell in a fully extended condition.

Ans : MAIN 2008
Turgid

25. The process which does not require the expenditure of metabolic energy for the upward movement of water.

Ans : SQP 2017
Passive absorption

26. What is suction pressure ?

Ans : SQP 2003

The net force with which the water is drawn into a cell is called suction pressure.

- 27.** The disc like structures of chloroplast in which chlorophyll is present.

Ans : MAIN 2001
Thylakoid.

- 28.** Movement of solvent molecule from its higher concentration to its lower concentration through a semipermeable membrane.

Ans : SQP 2010
Osmosis

- 29.** Pressure of the cell contents on the cell wall.

Ans : MAIN 2004
Turgor pressure

- 30.** The tissue which conducts manufactured food in plants.

Ans : MAIN 2015
Phloem

- 31.** A solution whose concentration is greater than the cell sap.

Ans : COMP 2023
Hypertonic solution

- 32.** A solution whose concentration is equal to the cell sap.

Ans : MAIN 2020
Isotonic solution

- 33.** Two factors that affect water potential.

Ans : COMP 2014
Atmospheric pressure ; Number of moles of the substance present

- 34.** A solution whose concentration is less than cell sap.

Ans : COMP 2018
Hypotonic solution

- 35.** The movement of molecules of substance from its higher concentration to its lower concentration.

Ans : SQP 2014
Diffusion

- 36.** The condition of the cell when it is placed in a hypotonic solution.

Ans : MAIN 2021
Deplasmolysis

- 37.** The kind of cells that constitute the cortex of a root.

Ans : MAIN 2012
Parenchyma

- 38.** The condition of a cell when it is kept in a hypotonic solution.

Ans : COMP 2000
Turgidity

- 39.** The term for the inward movement of solvent molecules through the plasma membrane of a cell.

Ans : MAIN 2009
Endosmosis

- 40.** The force which helps in the conduction of water.

Ans : COMP 2004
Cohesive force/Transpiration pull.

- 41.** The pressure, which is responsible for upward movement of water across the cortical cells of the root.

Ans : SQP 2017
Root pressure

- 42.** The organ that transports water from the soil to another parts of the plant.

Ans : COMP 2019
Root hairs

- 43.** The process by which molecules distribute themselves evenly within the space they occupy.

Ans : MAIN 2010
Diffusion

- 44.** The upward movement of water and minerals from roots to leaves and other parts of plants.

Ans : SQP 2017
Ascent of sap

- 45.** A solution whose concentration is greater than that of cell sap.

Ans : MAIN 2002

Hypertonic solution

46. The unique property of water which make it possible to rise in tall plants.

Ans : MAIN 2004

Cohesion and adhesion

47. The term which refers to relative concentrations of solutes of two solutions.

Ans : SQP 2001

Tonicity

48. Exudation of watery sap from an injured part of the plants.

Ans : MAIN 2006

Bleeding

49. A semi-permeable membrane in plants.

Ans :

Cell membrane

50. A solution in which cell swells up.

Ans :

Hypotonic

51. The condition in which cell shrinks.

Ans : SQP 2023

Flaccid

DIRECTION : Give the biological / technical term for the following :

52. The process of uptake of mineral ions against the concentration gradient using energy from the cell.

Ans : COMP 2016

Active transport

53. Movement of molecules of a substance from their higher concentration to lower concentration when they are in direct contact.

Ans : MAIN 2018

Diffusion

54. A membrane which allows the passage of molecules selectively.

Ans : SQP 2012

Semi-permeable membrane

55. The process of mixing of two different substances/ molecules.

Ans : MAIN 2010

Diffusion.

DIRECTION : Complete the following :

56. Wooden doors swell up in rainy season due to _____.

Ans : COMP 2011

Imbibition

57. _____ tissue translocate food in plants.

Ans : MAIN 2011

Phloem

58. The pressure that helps the water to move up in a plant is _____.

Ans : SQP 2008

Root pressure

59. In a hypotonic solution, cell becomes _____.

Ans : COMP 2017

Turgid

60. Root pressure can be measured by _____.

Ans : SQP 2009

Manometer

61. Water potential of a cell is lowered by the addition of _____.

Ans : COMP 2021

Solutes

62. The concentration of the cell sap _____ as plasmolysis takes place.

Ans : MAIN 2004

Increases

63. When plants absorb water from the soil, the water potential of root cell is _____ than the soil.

Ans : SQP 2010

low

64. The solution which has the same concentration of dissolved particles as inside the cell is called _____.

- Ans :** MAIN 2023
Isotonic
- 65.** The condition opposite to turgid is _____.
Ans : COMP 2021
Flaccid
- 66.** Root hair is an extension of _____.
Ans : COMP 2018
Epidermal cell
- 67.** _____ does not require an energy input to operate.
Ans : SQP 2020
Passive transport
- 68.** The first process by which water enters into the seed coat when a seed is placed in suitable situation for germination is _____.
Ans : MAIN 2010
Imbibition
- 69.** The loss of turgor of guard cells result in _____ of stomata.
Ans : COMP 2016
Closing
- 70.** A plasmolysed cell has _____ protoplast.
Ans : SQP 2014
Shrunken
- 71.** A solution which has lower concentration of solute molecules, has a _____ osmotic pressure.
Ans : MAIN 2011
Greater
- 72.** Metabolic energy of the cell is utilized in _____ absorption of water .
Ans : COMP 2009
Active
- 73.** Raisin swells up when kept in a _____ solution.
Ans : MAIN 2001
Hypotonic
- 74.** The cell membrane is _____.
Ans : COMP 2000
Semipermeable
- 75.** _____ is an example of a semipermeable membrane.
Ans : MAIN 2014
Egg membrane/Goat's bladder
- 76.** Leaves get wilted if _____ is removed from the plant.
Ans : COMP 2020
Xylem
- 77.** The pressure which develops in the cortical cells of root exerts force to push water upward is called _____.
Ans : SQP 2015
Root pressure
- 78.** The root hair is an extension of _____.
Ans : MAIN 2022
Epiblema/epidermis of root cells
- 79.** Absorption of water in plants takes place through the roots by the process of _____.
Ans : SQP 2003
Osmosis
- 80.** _____ helps in the opening of stomata.
Ans : COMP 2014
Turgidity
- 81.** The condition of a cell when it is placed in a hypertonic solution is called _____.
Ans : MAIN 2008
Flaccidity
- 82.** _____ is the medium through which transport of minerals takes place in plants.
Ans : SQP 2016
Water
- 83.** The spreading of molecules evenly within the space they occupy is _____.
Ans : MAIN 2009
Diffusion
- 84.** Recovery of protoplasm when a cell is kept in a hypotonic solution is _____.
Ans :

Ans :

COMP 2014

Deplasmolysis

85. The root hair is _____ and thin walled.

Ans :

SQP 2007

Unicellular

86. The diffusion of a _____ across the semipermeable membrane is known as osmosis.

Ans :

MAIN 2010

Solvent

87. The solution inside the vacuole is _____.

Ans :

COMP 2020

Cell sap

88. The cell wall of a root hair is _____ permeable.

Ans :

SQP 2022

Freely

89. Plants absorb water through _____.

Ans :

MAIN 2023

Root hairs

90. Osmosis is the movement of water molecules from its region of high concentration to a region of lower concentration through a _____ membrane.

Ans :

SQP 2014

Semi-permeable

91. Wooden doors swell up in rainy season due to _____.

Ans :

MAIN 2009

Wooden doors swell up in rainy season due to Imbibition.

92. _____ is the phenomenon of contraction of the cytoplasm from the cell wall.

Ans :

COMP 2011

Plasmolysis is the phenomenon of contraction of the cytoplasm from the cell wall.

93. The phenomenon of loss of water through a cut stem or injured part of plant is called _____.

Ans :

SQP 2015

The phenomenon of loss of water through a cut stem or injured part of plant is called bleeding

94. The following paragraph is related to absorption of water from the soil. Copy and complete the following paragraph by selecting the correct word from those given in the box. You may use the term only once.

exosmosis, hypertonic, osmosis, isotonic, hypotonic, cortical, endosmosis

Water enters the root hair from the soil by the process of _____. This is because the solution in the soil is _____ whereas the cell sap in the root hair cell is _____. The water then passes through the _____ cells (cell to cell) by _____ and reaches the xylem of the root.

Ans :

SQP 2004

Water enters the root hair from the soil by the process of endosmosis. This is because the solution in the soil is hypotonic whereas the cell sap in the root hair cell is hypertonic. The water then passes through the cortical cells (cell to cell) by osmosis and reaches the xylem of the root.

DIRECTION : State true or false;

95. Cells that have lost their water content are said to be deplasmolysed.

Ans :

SQP 2004, 1999

False

96. Xylem is the water conducting tissue in plants.

Ans :

MAIN 2005, 1999

True

97. Spreading of particles by mixing is called diffusion.

Ans :

SQP 2007, 1999

True

98. Root hairs are extension of epidermal cells.

Ans :

COMP 2009, 1995

True

99. Free movement of solutes in and out of the cell takes place across the cell membrane.

Ans :

SQP 2017

False. Free movement of solutes in and out of the cell takes place across the cell wall.

- 100.** Raisins swell up when placed in a medium which is hypertonic solution.

Ans : MAIN 2010

False. Raisins swell up when placed in a medium which is hypotonic solution.

- 101.** Cells with shrunken protoplasm are called turgid.

Ans : SQP 2022

False. Cells with shrunken protoplasm are called flaccid.

- 102.** Leaves wilt due to exosmosis.

Ans : MAIN 2018

True

- 103.** Bleeding is because of root pressure.

Ans : COMP 2013

False. Guttation is because of root pressure.

- 104.** The cell membrane is semi-permeable.

Ans : SQP 2011

True

DIRECTION : The statements given below are incorrect. Rewrite the correct statement by changing the underlined words of the statements.

- 105.** Free movement of solutes in and out of the cell takes place across the cell membrane.

Ans : MAIN 2017

Free movement of solute in and out of the cell takes place across the cell wall.

- 106.** The cell sap of root hair is Hypotonic.

Ans : SQP 2018

Hypertonic

DIRECTION : Choose the correct alternative :

- 107.** Marine fish when thrown under tap water bursts because of (endosmosis, exosmosis, diffusion, plasmolysis).

Ans : MAIN 2002

Endosmosis.

- 108.** The space between the cell wall and plasma membrane in plasmolysed cell is filled with (isotonic solution, hypotonic solution, hypertonic solution, water).

Ans : COMP 2000

Hypertonic solution

- 109.** The process by which molecules distribute themselves evenly within the space they occupy is termed as (osmosis, diffusion, active transport, imbibition).

Ans : MAIN 2001

Diffusion

- 110.** Synthesized food in green leaves is transported through (phloem, xylem, pith).

Ans : COMP 2017

Phloem

DIRECTION : Give biological reasons for :

- 111.** Salt and sugar are used in preserving food

Ans : SQP 2003

Higher concentration of salt or sugar protects the food from decay by bacteria and fungi due to plasmolysis. Hypertonic nature of such food plasmolyses cells of bacteria and fungi and makes them killed.

- 112.** Some plants show wilting of their leaves during mid day even when the soil is well watered.

Ans : MAIN 2010

During mid day the rate of transpiration is higher than the rate of absorption of water by roots hence show wilting.

- 113.** On sprinkling common salt on grass growing in a lawn, the grass is killed.

Ans : SQP 2004

Surrounding water becomes hypertonic hence water from root hair cells come out by process of exosmosis and cells get plasmolysed and die.

- 114.** Wilted lettuce leaves if kept in cold water become crisp.

Ans : COMP 2010, 2003

Leaves of wilted lettuce are plasmolysed but when kept in cold water they get deplasmolysis and become turgid and hence are crisp.

115. Potato cubes when placed in water become firm and increase in size.

Ans : MAIN 2011

Because of endosmosis the cells become turgid.

116. Root hairs become flaccid, when fertilizers are added to the moist soil around it.

Ans : SQP 2015

Because exosmosis takes place from root hair cells.

117. Transplanting of seedling to a flower bed in the evening is better than doing so in the morning.

Ans : COMP 2002

Because temperature goes down, there is less sunlight, rate of transpiration falls, less water is lost by seedling and during night roots get turgid and push into the soil.

118. Strips of potato placed in 50% sucrose solution appear soft and shriveled.

Ans : MAIN 2011, 1996

Water starts moving out in the outer concentrated sugar solution. After some time due to exosmosis potato strip becomes soft and shriveled due to loss of water as cells become flaccid.

119. Plants begin to die when excess of soluble fertilizers are added to the soil.

Ans : COMP 2007

Because of exosmosis, the root hair shrivel.

120. Active Transport and Diffusion [significance in plants]

Ans : MAIN 2017

Active transport : The plant for the absorption of mineral salts such as nitrates against concentration gradient occurs from soil to root hair cells.

Diffusion : For the exchange of respiratory gases. Removal of excess water by transpiration.

121. Give suitable biological reasons for the following statements :

Root hairs become flaccid and droop when excess fertilizers are added to the moist soil around them.

Ans : SQP 2019

Excessive fertilizers make the soil hypertonic as compared to root hair cells. Exosmosis takes place and root hair cells become flaccid due to which they droop.

122. The process of uptake of mineral ions against the concentration gradient using energy from cell.

Ans : MAIN 2002

Active transport.

123. Account for the wilted lettuce leaves become crisp/firm when placed in cold water for a while.

Ans : SQP 2010

Cold water being hypotonic helps in endosmosis. The cells of the lettuce leaves get deplasmolysis and become turgid.

124. Identify and name the process of movement of molecules from a region of higher concentration to a region of lower concentration.

Ans : MAIN 2010

Diffusion.

125. Plants growing in fertilized soil are often found to wilt if the soil is not adequately watered.

Ans : COMP 2001

If soil is fertilized and not well watered the concentration of soil solution becomes very high and water moves out of root hair cells due to exosmosis. If the process continues for a long time wilting will be observed.

126. Explain the term root pressure.

Ans : SQP 2010

The pressure which develops in the cortical cells of root and pushes the water and minerals into the xylem vessels.

127. Plants begin to die when excess of soluble fertilizers are added to the 'soil'.

Ans : MAIN 2005

Fertilizers along with soil water acts as hypertonic solution. Exosmosis takes place and cells of the plant or crop die.

128. Weeds can be killed by adding salt to it.

Ans : SQP 2007

When salt is added to the soil, water, near the roots of weeds, becomes hypertonic. So exosmosis takes place as cell sap of weeds is of lower concentration. Water moves out of the cells of weed and kills them.

129. The raisins swell up when kept in water.

Ans :

MAIN 2021

Water being hypotonic solution, enters into the raisins when they are kept in water due to endosmosis.

- 130.** Grapes shrink when kept in sugar solution.

Ans :

COMP 2018

Plasmolysis takes place when grapes are kept in sugar solution, so they shrink.

- 131.** Pickles can be preserved by adding salt to it.

Ans :

SQP 2013

By adding salt in pickles, the growth and multiplication of bacteria can be prevented by plasmolysis.

- 132.** Farmers usually transplant seedlings in a flower bed in the evening.

Ans :

COMP 2010

In the evening, transpiration rate is less than the root pressure. So seedlings remain intact and do not wilt.

- 133.** Leaves of sensitive plant droop down on a touch.

Ans :

MAIN 2007

The stimulus of touch leads to loss of turgor pressure at the base of the petioles of the sensitive plant and as a result the leaves droop down.

DIRECTION : Give a scientific term for the following:

- 134.** Loss of water through a cut stem.

Ans :

SQP 2020

Bleeding

- 135.** Sticking of water molecules to the surface of cell.

Ans :

MAIN 2023

Adhesive force

- 136.** The condition when the cell is placed in a hypotonic solution.

Ans :

SQP 2018

Turgidity

- 137.** Movement of water through a semi-permeable membrane.

Ans :

SQP 2009

Osmosis

DIRECTION : Choose the correct answer from each of the four options given below:

- 138.** Term for mixing of two different molecules.
[diffusion, osmosis, imbibition, endosmosis]

Ans :

MAIN 2014

Diffusion

- 139.** A cell shrink in a _____ solution.
[isotonic, hypotonic, hypertonic]

Ans :

COMP 2019

Hypertonic

DIRECTION : Define the following :

- 140.** Osmosis

Ans :

MAIN 2007

It is the movement of water (solvent) molecule from its higher concentration to its lower concentration through a semipermeable membrane.

- 141.** Isotonic solution

Ans :

SQP 2015

A solution whose concentration is equal to the concentration of the cell sap.

- 142.** Endosmosis

Ans :

COMP 2010

The movement of water molecules into a cell through a semipermeable membrane when it is kept in a hypotonic solution.

- 143.** Turgor pressure

Ans :

MAIN 2012

It is the pressure which develops in the confined part of an osmotic system due to osmotic entry of water into it.

- 144.** Exosmosis

Ans :

COMP 2017

The movement of water molecules out from a cell when a cell is placed in a hypertonic solution.

- 145.** Osmotic pressure

Ans :

SQP 2020

The pressure by which the water molecules tend to cross the semi-permeable membrane.

146. Semipermeable membrane**Ans :**

MAIN 2001

A membrane which allows the movement of solvent molecules only across it.

DIRECTION : Answer the following :

1. Mention one characteristic of roots for absorbing water from the soil.

Ans :

SQP 2025

Root hairs have thin cell walls Enormous surface area of roots Higher concentration of cell sap than soil water

2. A plasmolysed cell is shown along side. What is X?

[water, hypertonic solution, vacuole, protoplasm]

Ans :

COMP 2019

Hypertonic solution

3. Movement of water out of a cell is
[Diffusion, Endosmosis, Osmosis, Exosmosis]

Ans :

SQP 2004

Exosmosis

4. Wilting is due to lack of
[sugar, salt, water, none]

Ans :

COMP 2008

Water

5. Active transport needs
[energy, osmotic pressure, root pressure, all of them]

Ans :

MAIN 2013

Energy.

6. Write the name of the organ that transports water from the soil to other parts of the plant.

Ans :

COMP 2016

Root hair.

7. Define hypotonic solution.

Ans :

SQP 2012

A solution whose concentration is less than the cell sap is called as hypotonic solution.

8. What is flaccid condition of a cell?

Ans :

MAIN 2003

When a cell is placed in a hypertonic solution water diffuses out of the cell and the protoplast shrinks. The shrunken condition is called flaccid condition.

9. Name the vascular tissues which conduct water and translocate food.

Ans :

SQP 2015

Xylem – conducts water.

Phloem – translocates food.

10. How are root hairs adapted for absorption of water from the soil?

Ans :

MAIN 2017

(a) Root hairs are thin walled.

(b) The concentration of cell sap of root hair is more than the soil water.

11. What is ascent of sap?

Ans :

SQP 2018

The process by which water absorbed by the roots is conducted to the upper part of the plant.

12. Give advantages of plasmolysis.

Ans :

MAIN 2022

The advantages of plasmolysis are as follows.

(a) Weeds can be killed by adding salts in the fields.

(b) Addition of salt to pickles kills bacteria and thereby the pickles preserve.

13. What is wilting?

Ans :

COMP 2002

Drooping of leaves due to loss of turgidity.

14. What is importance of turgidity to plants?

Ans :

SQP 2004

It helps in the opening and closing of stomata. Turgidity provides rigidity to soft tissues.

15. What is the importance of osmosis to plants?

Ans :

MAIN 2009

It helps in the absorption of water and cell to cell movement of water.

16. How are mineral salts in plants absorbed?

Ans :

SQP 2017

Mineral salts are absorbed in the form of ions by active transport.

17. Name a solution whose concentration is greater than that of cell sap.

Ans : COMP 2019

Hypertonic solution.

18. Leaves of sensitive plant wilt and droop down on a slight touch. Why ?

Ans : MAIN 2023

Stimulus of touch leads to loss of turgor pressure at the base of leaflets and petioles.

DIRECTION : Distinguish between:

19. Plasmolysis and Deplasmolysis.

Ans : MAIN 2012

The difference between Plasmolysis and Deplasmolysis are as follows :

	Plasmolysis		Deplasmolysis
(a)	It takes place when a cell is kept in a hypertonic solution.	(a)	It takes place when plasmolysed cell is placed in a hypotonic solution.
(b)	Shrinkage of protoplast.	(b)	Swelling of protoplast.
(c)	Cells become flaccid.	(c)	Cells become turgid.

20. Osmotic pressure and Turgor pressure.

Ans : COMP 2016

The difference between Osmotic pressure and Turgor pressure are as follows :

	Osmotic Pressure		Turgor Pressure
(a)	It develops due to osmotic entry of water in a cell.	(a)	It is the pressure exerted by the cell contents on the cell wall.
(b)	It helps in the absorption of water.	(b)	It helps the plant in being erect.

21. Diffusion and Osmosis.

Ans : MAIN 2019

The difference between Diffusion and Osmosis are as follows :

	Diffusion		Osmosis
(a)	Movement of the molecules of solute or solvent.	(a)	Movement of water or solvent.
(b)	Occurs with or without a semipermeable membrane.	(b)	Semipermeable membrane is needed.

22. Active and Passive absorptions.

Ans : SQP 2007

The difference between Active and Passive absorptions are as follows :

	Active Absorption		Passive Absorption
(a)	It takes place from lower concentration to higher concentration.	(a)	It takes place from higher concentration to lower concentration.
(b)	Cell energy from ATP is required.	(b)	Cell energy is not required.

23. Endosmosis and Exosmosis.

Ans : SQP 2000

The difference between Endosmosis and Exosmosis are as follows :

	Endosmosis		Exosmosis
(a)	It occurs when a cell is placed in a hypotonic solution.	(a)	It occurs when a cell is placed in a hypertonic solution.
(b)	Water moves into the cell.	(b)	Water moves out of the cell.

24. Flaccid and Turgid conditions.

Ans : MAIN 2006

The difference between Flaccid and Turgid conditions are as follows :

	Flaccid Condition		Turgid Condition
(a)	It is a condition when a cell is placed in a hypertonic solution.	(a)	It happens when a cell is placed in hypotonic solution.

(b)	Water is lost from the plant due to exosmosis.	(b)	Water enters into a cell due to endosmosis.
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25. Osmosis and Plasmolysis.

Ans :

MAIN 2004

The difference between Osmosis and Plasmolysis are as follows :

Osmosis	Plasmolysis
It is the movement of water from its region of higher concentration to its region of lower concentration through a semi-permeable membrane.	It is the shrinkage of protoplasm when a cell is placed in a hypertonic solution.

26. Hypertonic and Hypotonic solutions.

Ans :

SQP 2007

The difference between Hypertonic and Hypotonic solutions are as follows :

	Hypertonic Solution		Hypotonic Solution
(a)	A solution whose concentration is more than the cell sap.	(a)	A solution whose concentration is less than the cell sap.
(b)	Its osmotic pressure is more.	(b)	Its osmotic pressure is less.

27. Xylem and Phloem.

Ans :

MAIN 2011

The difference between Xylem and Phloem are as follows :

	Xylem		Phloem
(a)	Helps in the conduction of water and minerals.	(a)	Helps in the transport of prepared food.
(b)	It is a dead tissue.	(b)	It is a living tissue.

28. Wall pressure and turgor pressure.

Ans :

COMP 2017

The difference between Wall pressure and turgor pressure are as follows :

Wall pressure	Turgor pressure
The pressure exerted by the cell wall on the contents of the cell.	The pressure exerted by the contents of the cell on the cell wall.

TWO MARKS QUESTIONS

29. Explain the term — Active transport.

Ans :

SQP 2025

It is the movement of salt or ion across a cell membrane from lower to higher concentration by the use of energy.

30. Define the following :

- (i) Hypotonic solution.
- (ii) Active transport.

Ans :

MAIN 2009

- (i) Hypotonic solution - A solution having low osmotic pressure or lower concentration of solutes as compared to another solution.
- (ii) Active transport - Passage of substances (ions or salts) from already low concentration to their higher concentration (against concentration gradient) by utilization of energy of the cell.

31. Differentiate diffusion and osmosis.

Ans :

MAIN 2015

The difference between Differentiate diffusion and osmosis are as follows :

Diffusion	Osmosis
The free movement of molecules of various substances (solid, liquid or gas) from the region of their higher concentration to the region of their lower concentration when the two are in direct contact.	The movement of water molecules from the region of their higher concentration to the region of their lower concentration through a semi permeable membrane.

32. Explain the terms :

- (i) Diffusion
- (ii) Turgidity

Ans :

COMP 2010

- (i) It is the movement of molecules of a substance from a region of high concentration to a region of lower concentration.
- (ii) Turgidity is the swelled up state of the cell due to absorption of water.

33. Explain the term plasmolysis. Give one application of this phenomenon in our daily life.

Ans : SQP 2005

Shrinkage of protoplast of a plant cell from its cell wall under the influence of hypertonic solution is called plasmolysis and the cell in this state is said to be limp or flaccid. This condition is called flaccidity. Adding salt in pickles and sugar in jams, jellies preserve them from decaying by plasmolysing the bacterial cell.

34. Write the role of cohesive force in ascent of sap.

Ans : COMP 2017

Cohesive force is the force created due to mutual attraction between water molecules. Due to transpiration, a large quantities of water are lost. Water forms a continuous column in the xylem of the leaves to the xylem of the roots. Due to cohesion, the water column does not break.

35. Rewrite the completed explanation by inserting the key word in the space indicated by.

Osmosis is the movement of water molecule from its region of higher concentration to its region of lower concentration through a ‘^’ membrane.

Ans : MAIN 2008

Osmosis is the movement of water molecule from its region of higher concentration to its region of lower concentration through a semi-permeable membrane.

36. Write an experiment to prove that phloem conducts food.

Ans : SQP 2001

Take a potted plant. Cut a ring around the stem deep enough to penetrate the phloem. After a few weeks it is observed that the part of the stem above the ring has grown in diameter and adventitious roots have developed. This accumulation of food proving that phloem conducts food/storage. Since food does not reach below the ring, the stem shrivells.

37. Explain the term plasmolysis. Give one application of this phenomenon in our daily lives.

Ans : SQP 2021

Plasmolysis is the shrinkage of protoplasm from the cell wall when a cell is placed in a hypertonic solution. Preservation of jams is done by adding sugar; fish, meat, etc. are preserved by adding salt to them. This creates a hypertonic medium for the microorganisms that are killed.

38. What is transpiration pull?

Ans : SQP 2010

Due to transpiration, water is lost from the leaves. This decreases the water potential. More water molecules are pulled up due to cohesion of water molecules. This pulling force is transpiration pull.

39. Demonstrate water absorption by roots.

Ans : MAIN 2018

Take two test tubes – A and B. Fill both the test tubes with water. Insert a rooted balsam plant into test tube A. Add a drop of oil in both the test tubes. Do not keep a plant in test-tube B. It is observed that in a day or two the level of water in test-tube A falls and not in test tube B. This proves that roots absorb water.

40. What is active transport in plants?

Ans : COMP 2021

It is the process of movement of molecules from a lower concentration to a higher concentration across the cell membranes. This requires energy as the molecules move against the concentration gradient.

41. What is importance of diffusion in plants?

Ans : MAIN 2017

- (i) Gaseous exchange takes place through stomata.
- (ii) The ions are absorbed by the simple diffusion during passive salt intake.

42. What is total/evident plasmolysis and how it differs from incipient plasmolysis ?

Ans : COMP 2005

The condition in which water from the cell is removed completely due to exosmosis and no more shrinkage is possible in its protoplast is called total/evident plasmolysis while primary stage of plasmolysis in which protoplast just starts shrinking away from cell wall is called incipient plasmolysis.

43. Give one example of osmosis occurring in human body and a green leaf.

Ans : MAIN 2017

In human body, it is movement of water from body fluid into the blood.

In green leaf, it is movement of water into the mesophyll cells from the leaf veins.

44. Can osmosis be regarded as diffusion ?

Ans : COMP 2009

Yes, it is a kind of diffusion occurring through semipermeable membrane as the movement of water molecules take place from their higher to their lower concentration.

45. Why do plants growing in fertilized soil often found to wilt if the soil is not adequately watered?

Ans : MAIN 2017

The fertilizers with inadequately watered soil form a hypertonic condition so that it results in plasmolysis and hence the plant shows wilting.

46. Give any four examples of semipermeable membrane.

Ans : SQP 2001

- (i) Egg membrane
- (ii) Cellophane paper
- (iii) Parchment paper
- (iv) Goats bladder

47. What will happen if the experiment on osmosis is performed with a boiled potato ?

Ans : MAIN 2013

Osmosis will not take place and there will be neither rise nor decrease in the level of sugar solution in the osmoscope. This is because on boiling cell membrane loses its semipermeability.

48. Why are the following used in experiments?
Cobalt chloride paper and goat bladder.

Ans : SQP 2009

Goat bladder is used in osmosis experiments as it is semi-permeable membrane. Cobalt chloride paper is used in transpiration experiments to find out the rate of transpiration.

49. Answer the following questions:

- (i) Why is the ring experiment conducted in plants?
- (ii) Differentiate transpiration and guttation on

the basis of state of water.

Ans : MAIN 2020

- (i) To prove that phloem is responsible for conduction of food material.
- (ii) Transpiration – water vapour Guttation – liquid water

50. Give reasons:

- (i) Why do people gargle with salt solution during throat infection?
- (ii) Lettuce leaves remain fresh in cold water.

Ans : SQP 2010

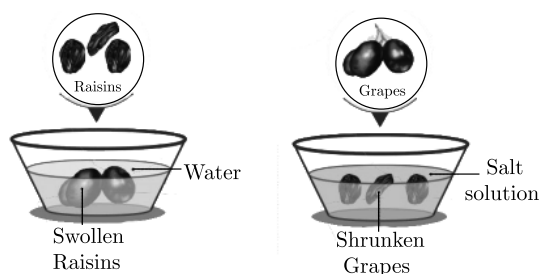
- (i) While gargling, bacteria comes in contact with salt solution. They are plasmolysed and killed. Thus, it gives people some relief.
- (ii) Lettuce leaves when kept in cool water do not become dull or wilt as endosmosis takes place and they remain fresh.

51. (i) Give two examples of turgor movements in plant.
(ii) Give two examples of semi-permeable membrane, other than cell membrane.

Ans : MAIN 2001

- (i) (a) Wilting of leaves
(b) Opening and closing of stomata.
- (ii) (a) Egg membrane (semi-permeable).
(b) Parchment paper (semi-permeable).
(c) Goat bladder (semi-permeable).

52. (i) What is the aim of the experiments in A and B?
(ii) What happens when dry seeds are soaked in water? Name the term used for it.



Ans : COMP 2022

- (i) Experiment A demonstrates endosmosis in raisins.
Experiment B demonstrates exosmosis in grapes.
- (ii) Dry seeds when soaked in water and swells up. The term used is imbibition.

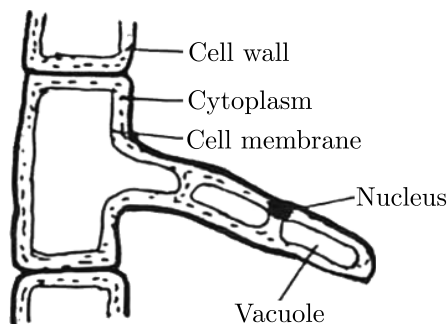
THREE MARKS QUESTIONS

53. Draw a neat, labelled diagram of a root hair.

Ans :

SQP 2025

Diagram of a root hair.



54. How does turgor help in opening and closing of stomata?

Ans :

COMP 2014

Opening and closing of stomata is done with the help of guard cells. Each guard cell has a thick outer wall and a thin inner wall. Guard cells contain chloroplasts where photosynthesis is carried out. The osmotic pressure of the guard cells increases as water is absorbed from the surrounding cells, thus the guard cells become turgid. The outer wall stretches outwards and the stomatal pore widens through which exchange of gases takes place. At night, slowing down of photosynthesis process causes the guard cells to lose water. The inner walls of the chloroplast of the guard cells become flaccid and thus closes the stomatal pore.

55. Potato cubes 1 cm in size were placed in two containers, one containing water, the other containing concentrated sugar solution. After about 24 hours when the cubes were examined, then those placed in water were found to be firm and had increased in size by a few millimeters. Those placed in concentrated sugar solution were found to be soft and had decreased in size. Use the above information to answer the questions that follow :

- Account for the firmness and increase in size of the potato cubes which were placed in water.
- Account for the softness and decrease in size of the potato cubes which were placed in the sugar solution.

- Name and define the physical process being investigated in this experiment.

Ans :

MAIN 2001

- Cubes are placed in hypotonic solution so endosmosis takes place and cell becomes turgid resulting in firmness and increase in size.
- Placed in sugar solution hence becomes soft and decrease in size because of exosmosis.
- Osmosis : It is the flow of water molecules from the region of their higher concentration to the region of their lower concentration through a semipermeable membrane.

56. Match the columns:

	Column A		Column B
(i)	plasma membrane	(a)	minerals
(ii)	root hair	(b)	bleeding
(iii)	phloem	(c)	unicellular
(iv)	cell sap	(d)	conduction of food
(v)	active transport	(e)	semi-permeable

Ans :

MAIN 2004

(i)-(e), (ii)-(c), (iii)-(d), (iv)-(b), (v)-(a),

57. Match the following Column :

	Column I		Column II
(a)	Plasmolysis	(i)	Active transport
(b)	Absorption of ions from soil against concentration gradient.	(ii)	Acts due to cell sap on cell wall
(c)	Turgor pressure	(iii)	Hypertonic medium
(d)	Phloem	(iv)	Absorption of water by living or dead cells of plants.
(e)	Imbibition	(v)	Translocation of food

Ans :

COMP 2008

(a) – (iii), (b) – (i), (c) – (ii), (d) – (v), (e) – (iv)

58. (i) Define suction pressure.
(ii) Which condition is bidirectional and

unidirectional? Diffusion and osmosis.

- (iii) Write four significance of plasmolysis in our daily life.

Ans :

MAIN 2017

- (i) The pressure by which water is drawn into a cell is called suction pressure.
- (ii) Diffusion is bidirectional. Osmosis unidirectional.
- (iii) (a) Sucking leech can be removed from a person by adding salt to the leech.
- (b) Plants growing on the walkways can be removed by adding salt to the plant roots.
- (c) Jam, jellies, pickles can be preserved by adding sugar and salt to them.
- (d) Weedicides are used in crop fields to kill the weeds.
- (e) While gargling, bacteria are killed due to plasmolysis.

59. Give reasons for the following :

- (i) We gargle with saline solution in case of throat infection.
- (ii) Bacteria and fungi do not grow in pickles, jams, jellies and squashes.
- (iii) The leaves of wilted lettuce if kept in cold water become crisp.

Ans :

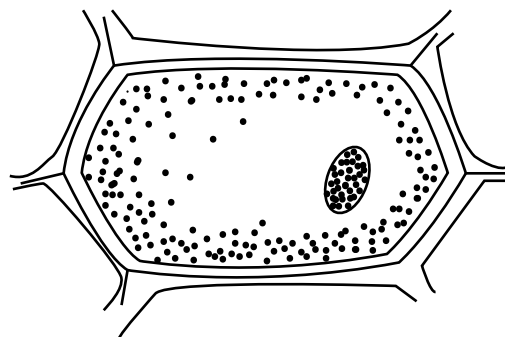
SQP 2007

- (i) Salt solution is hypertonic. When it comes in contact with bacteria in the throat, they get plasmolysed and are killed which gives us relief from the infection.
- (ii) Pickles, jams, jellies and squashes are in hypertonic solutions of either salt or sugar. It causes plasmolysis in bacteria and other microorganisms which cannot grow in such an unfavourable environment or get killed. Thus these food materials can be preserved for long durations.
- (iii) Wilted lettuce has plasmolysed cells which are flaccid but when such leaves are kept in water, endosmosis takes place and cells become turgid. In such a condition, the leaves become crisp.

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FIVE MARKS QUESTIONS

60. The figure given below shows the epidermal cells of an onion bulb. This cell was then transferred to a drop of sugar solution.

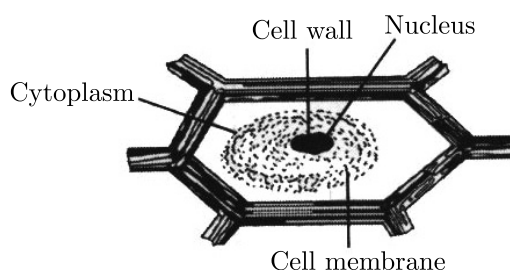


- (i) Draw a well labelled diagram of the epidermal cell as it would appear after immersion in a strong sugar solution.
- (ii) What scientific term is used for the changes as shown in (i) above ?
- (iii) What should be done to restore the cell back to its original condition ?
- (iv) Give the scientific term for the recovery of the cell as a result of the step taken in (iii) above.
- (v) Define the term osmosis.

Ans :

SQP 2013

- (i)



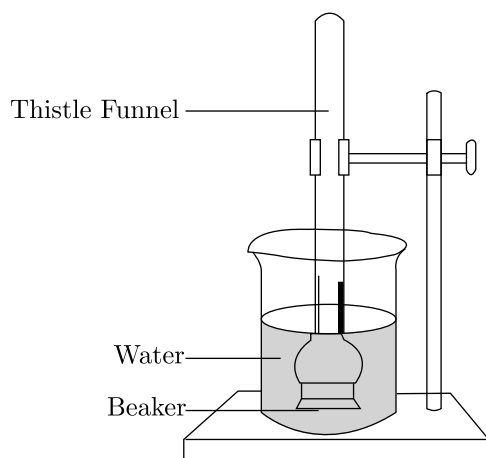
- (ii) Plasmolysis
- (iii) Keep the cell immediately back in to water before the cell dies.
- (iv) Deplasmolysis
- (v) Osmosis is the movement of water molecules from the region of their higher concentration to the region of their lower concentration through a semipermeable membrane.

61. Given below is the diagram of an apparatus set up to study a very important physiological process :

- (i) Name the process being studied.
- (ii) Explain the process.
- (iii) What change would you observe in the thistle

funnel containing sugar solution after about 10 minutes ?

- (iv) Is sugar solution hypertonic or hypotonic ?
 (v) Explain why much salt is added to pickles.

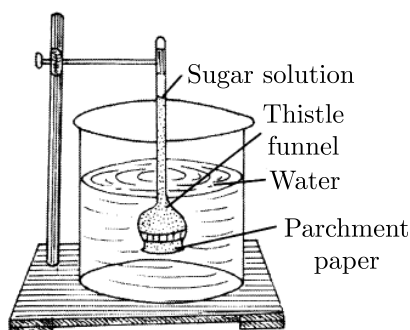


Ans :

SQP 2010

- (i) Osmosis
- (ii) Osmosis is the diffusion of water molecules through a semipermeable membrane from a dilute to a concentrated solution.
- (iii) The level of sugar solution in the stem of thistle funnel rises due to the entry of water from the beaker in the thistle funnel.
- (iv) Hypertonic, as it draws water from the beaker.
- (v) When salt is added to pickles, it makes a hypertonic solution. It draws water from the microbes by exosmosis, plasmolysing them, resulting in their death.

62. The diagram represents an experimental set up to demonstrate a vital process. Study the same and then answer the questions that follow :



- (i) Name the process.
- (ii) Define the above named process.
- (iii) Mention two advantages of this process to the plant.

- (iv) Name two liquids that could be used in this experiment.
- (v) Why did the level of the liquid in the vertical tube rise ?

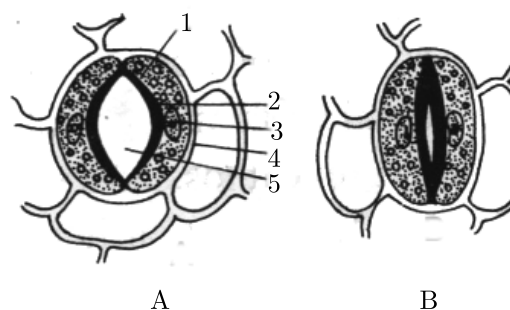
Ans :

COMP 2017

- (i) The experiment demonstrates the process of osmosis.
- (ii) Transfer of water or solvent molecules from a solution of lower concentration to a solution of higher concentration through a semi-permeable membrane is called osmosis.
- (iii) 1. Helps in water absorption.
2. Helps in stomatal movements.
- (iv) Distilled water and concentrated sugar solution.
- (v) The level of the liquid in the vertical tube rises due to the entry of water into it through the goat's bladder by means of the process of osmosis.

63. Given are the diagrams of a certain structure in plants in two conditions.

- (i) Name the structure shown.
- (ii) Name the parts numbered 1 - 5.



- (iii) What is the most apparent difference between A and B in the structure shown ?
- (iv) Describe the mechanism which brings about the change in the structures depicted in A and B.

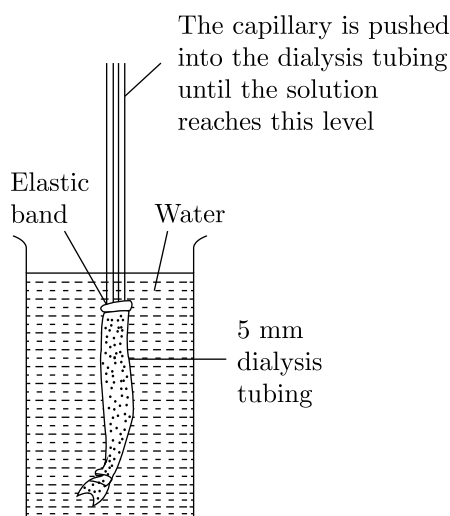
Ans :

MAIN 2012

- (i) Stomata
- (ii) 1 - Guard cell.
2 - Thick cell wall towards the stomatal opening.
3 - Nucleus.
4 - Adjoining epidermal cell.
5 - Stomatal opening.
- (iii) A shows an open stomata.
B shows a closed stomata.
- (iv) The mechanism of opening and closing of stomata : The opening and closing of stomata

is regulated by the amount of water and solutes present in the guard cells. The guard cells have thick inner wall facing the opening and thin outer wall on the opposite side. Their cytoplasm contains chloroplasts. During the day, the guard cells begin photosynthesis and the sugar produced during the process increases the osmotic pressure which draws in water from the adjoining cells by endosmosis. Hence, the guard cells become turgid and bulge outwards due to their thin outer walls, thus widening the stomata. During stomatal closure reverse change occur.

64. The apparatus arranged below signifies an important process:



- Name the process.
- Where does this process occur in plants ?
- What solution is placed inside the dialysis tubing ?
- What happens to the level of the solution in the capillary tube ?
- Define the process mentioned in (i) above.

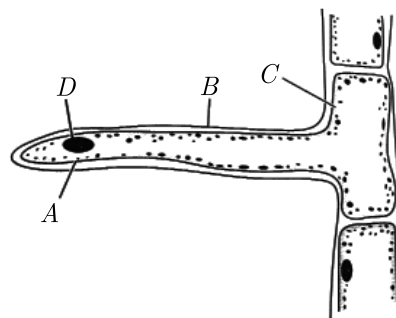
Ans :

MAIN 2013

- Osmosis.
- In the root hairs of plants.
- Strong sugar solution or the salt solution.
- The level in the capillary tube rises above.
- Osmosis is a physiological process that takes place when two solutions having different concentrations or a solution and its pure solvent are separated by a semi-permeable membrane.

65. The diagram below represents a layer of epidermal cells showing a fully-grown root hair. Study the

diagram and answer the questions that follow :

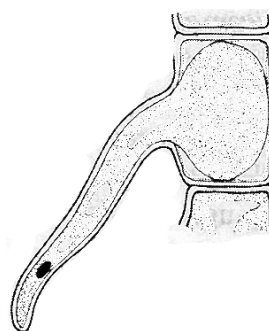


- Name the parts labelled A, B, C and D.
- The root hair cell is in a turgid state. Name and explain the process that caused this state.
- Mention one distinct difference between the parts labelled A and B.
- Draw a diagram of the above root hair cell as it would appear when a concentrated solution of fertilizers is added near it.

Ans :

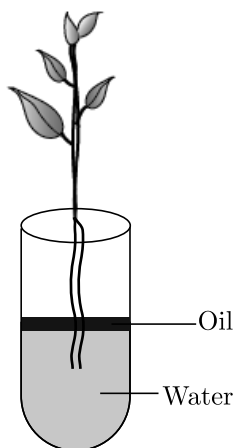
COMP 2011

- A - Cell wall, root hair, B - Cell membrane
C - Cytoplasm, D - Nucleus
- Endosmosis; The entry of the water from the soil into the root hair results in turgor pressure and it become turgid.
- Cell wall is permeable whereas cell membrane is differentially semi-permeable.
-



66. Study the diagram and answer the questions that follow :

- Name the process being studied in the experiment.
- Explain the process mentioned in (i) above.
- Why is oil placed over water ?
- What do we observe with regard to the level of water when this set up is placed in
 - bright sunlight
 - humid conditions
 - windy day ?



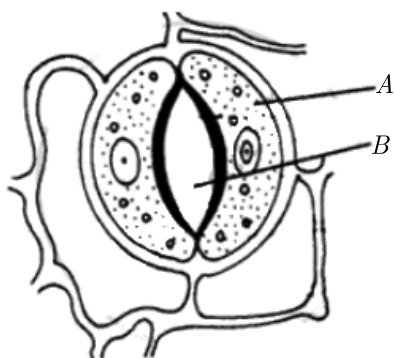
- (v) Mention any three adaptations found in plants to overcome the process mentioned in (ii) above.

Ans :

SQP 2011

- (i) Transpiration
- (ii) The loss of water in the form of water vapour from aerial parts of the plant is called transpiration.
- (iii) To prevent loss of water by evaporation.
- (iv) (1) Transpiration is accelerated and level of water fall down/lowered.
(2) Low humidity transpiration increases and water level falls down and vice versa.
(3) Increases the rate of transpiration and lowers the water level.
- (v) Three adaptations are :
 - (a) Thick cuticle
 - (b) Sunken stomata
 - (c) Loss of leaves

67. The diagram below represents a structure found in a leaf. Study the same and answer the questions that follow :



- (i) Name the parts labelled A and B.
- (ii) What is the biological term for the given structure.

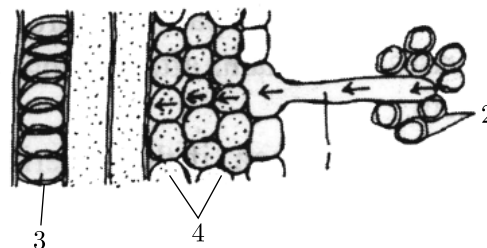
- (iii) What is the function of part labelled A ?
- (iv) Mention two structural features of A, which help in the function of mentioned in (iii) above.
- (v) Where is this structure likely to be found in a leaf ?
- (vi) The above structure helps in the process of transpiration. Explain the term transpiration.
- (vii) How many other cells are found surrounding this structure as seen in the diagram ?

Ans :

MAIN 2009

- (i) (A) Guard cell, (B) Stoma/stomatal pore
- (ii) The biological term for the structure is Stomata.
- (iii) The function of part labelled A is it helps in opening of stomata due to turgidity during daytime and closing of stomata due to flaccidity at night.
- (iv) Two structural features of A is that
 - (a) Guard cells outer wall is thin and can be stretched.
 - (b) It consists of chloroplast which helps to increase sugar level in guard cells making it hypertonic so that it can absorb water from adjoining cells and become turgid.
- (v) This structure is found on the upper and lower epidermis of leaves.
- (vi) Transpiration is the loss of water in the form of water vapour from the aerial exposed parts of the plant.
- (vii) Five other cells are found surrounding this structure as seen in the diagram.

68. The figure given below is a diagrammatic representation of a part of the cross section of the root in the root hair zone. Study the same and then answer the questions that follow :



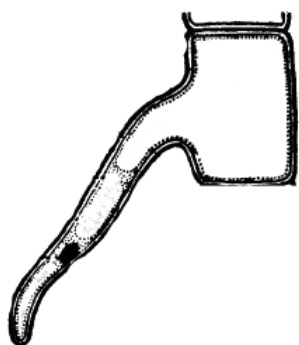
- (i) Name the parts indicated by the guidelines 1 to 4.
- (ii) Which is the process that enables the passage of water from the soil into the root hair?
- (iii) Name the pressure that is responsible for the movement of water in the direction indicated by the arrows. Define it.

- (iv) Due to an excess of this pressure sometimes drops of water are found along the leaf margins of some plants especially in the early mornings. What is the phenomenon called ?
- (v) Draw a well labelled diagram of the root hair cell as it would appear if an excess of fertilizer is added to the soil close to it.

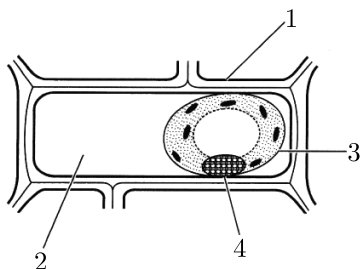
Ans :

MAIN 2016

- (i) 1 - Root hair
2 - Soil particles
3 - Xylem
4 - Cortex cells
- (ii) Osmosis, water potential gradient.
- (iii) Suction pressure or hydrostatic pressure. It is the pressure that develops in the confined part of an osmotic system due to osmotic entry of water into it.
- (iv) Guttation
- (v)



69. The diagram given below represents a plant cell after being placed in a strong sugar solution. Study the diagram and answer the questions that follow:



- (i) What is the state of the cell shown in the diagram?
- (ii) Name the structure that acts as a selectively permeable membrane.
- (iii) Label the parts numbered 1 to 4 in the diagram.
- (iv) How can the above cell be brought back to

its original condition? Mention the scientific term for the recovery of the cell.

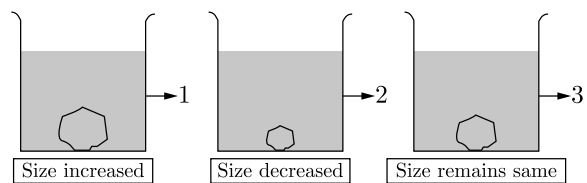
- (v) State any two features of the above plant cell which is not present in animal cells.

Ans :

MAIN 2017

- (i) The state of the cell is Plasmolysed
- (ii) Cell membrane
- (iii) 1. Cell wall
2. Strong sugar solution
3. Cell membrane
4. Nucleus.
- (vi) By putting it in hypotonic solution/water.
The scientific term for the recovery of the cell is deplasmolysis.
- (v) (i) Cell wall
(ii) Vacuole.

70. A candidate in order to study the process of osmosis has taken 3 potato cubes and put them in 3 different beakers containing 3 different solutions. After 24 hours, in the first beaker the potato cube increased in size, in the second beaker the potato cube decreased in size and in the third beaker there was no change in the size of the potato cube. The following diagram shows the result of the same experiment:



- (i) Give the technical terms of the solutions used in beakers, 1, 2 and 3.
- (ii) In beaker 3 the size of the potato cube remains the same. Explain the reason in brief.
- (iii) Write the specific feature of the cell sap of root hairs which helps in absorption of water.
- (iv) What is osmosis?
- (v) How does a cell wall and a cell membrane differ in their permeability?

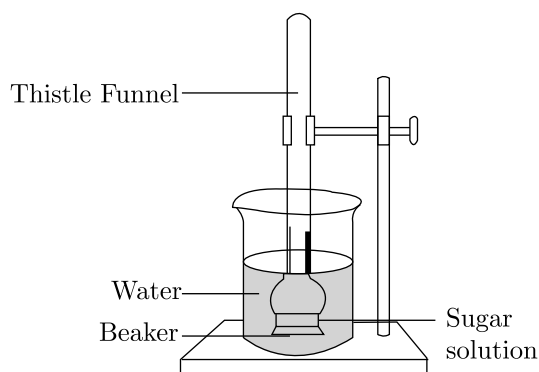
Ans :

COMP 2014

- (i) (1) Hypotonic, (2) Hypertonic, (3) Isotonic.
- (ii) The solution in the beaker is isotonic (outside solution of same concentration as the cell sap). So, osmosis does not take place.
- (iii) Root hairs have cell sap which has a higher concentration than the soil water. Root hairs also contain plasma membrane which allows water molecules to pass through it. So, root hairs absorb water from the soil.

- (iv) It is the movement of water molecules from their higher concentration to their lower concentration through a semi-permeable membrane.
- (v) Cell wall is freely permeable. Cell membrane is semi-permeable.

71. Given diagram shows an apparatus set-up to study a very important physiological process:



- (i) Name the process being studied.
- (ii) What change would you observe in the thistle funnel containing sugar solution after about 10 minutes?
- (iii) Is sugar solution-hypertonic or hypotonic?
- (iv) Name the part of the plant cell which is represented by the sugar solution.
- (v) Explain why much salt is added to pickles.

Ans :

SQP 2010

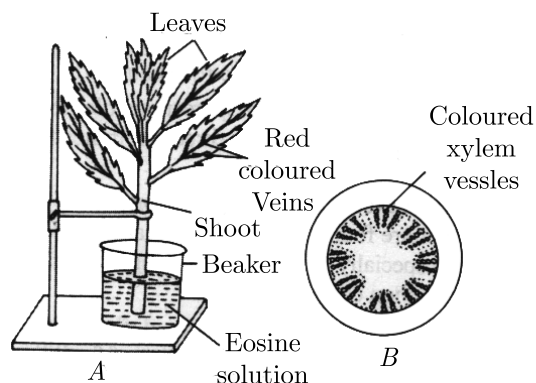
- (i) Osmosis.
- (ii) The level of the sugar solution in the thistle funnel will rise.
- (iii) Sugar solution is hypertonic solution.
- (iv) Cell sap in the vacuole.
- (v) Salt acts as a hypertonic medium. It prevents the multiplication of bacteria by the method of and plasmolysis, so that pickles can be preserved.

72. The diagram given below represents an experimental set up to demonstrate vital process. The veins of the leaves have become coloured after some time. Study the same by cutting thin sections of stem and leaves and then answer the questions that follow :

- (i) Name the process.
- (ii) Define the above named process.
- (iii) What are the processes responsible for the rise of water in herbaceous plants and large trees ?
- (iv) Suggest the name of pathway through which

the water rises in the plants after cutting section of leaf and stem.

- (v) What would happen, if the experimental set-up was placed in dark in cupboard ?
- (vi) What precautions would you follow for the success of the experiment ?



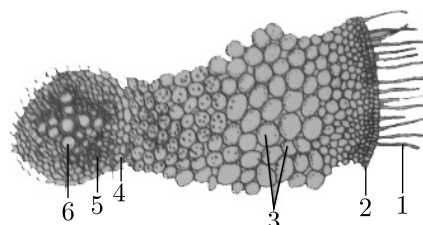
Ans :

SQP 2023

- (i) Ascent of sap.
- (ii) The upward transport of water along with dissolved minerals from the roots to the aerial parts of the plants.
- (iii) Root pressure in case of herbaceous plants and transpiration pull in case of large trees.
- (iv) Xylem elements.
- (v) There will be no rise of water due to the absence of conditions that favour transpiration.
- (vi) Balsam should be cut under water to avoid the entry of air bubbles in the xylem channels.
 1. An oblique cut should be given at the base of shoot.
 2. Take fresh shoot or freshly uprooted plants of balsam or petunia with white flowers.

73. Given below is the diagrammatic representation of the transverse section of a part of a plant. Study the same and answer the questions that follow :

- (i) Name the part of the plant that is shown.
- (ii) Label the parts 1 to 6 indicated in the diagram.
- (iii) Write the functions of parts 3 and 5.



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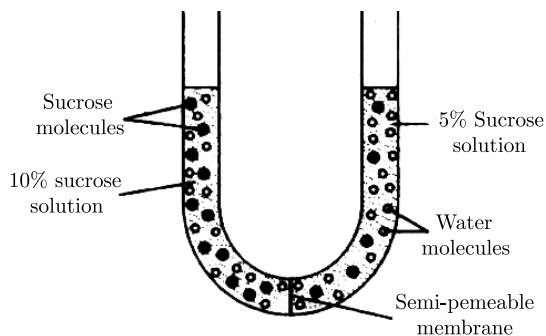
Ans :

MAIN 2003

- (i) The part of the plant that is shown in a cross-section of a young root.
- (ii) 1. Root hair
2. Epidermis
3. Cortex
4. Endodermis
5. Phloem
6. Meta xylem (Xylem).
- (iii) Part - 3 : Function of Cortex : (a) Storage of starch grain.
Conduct water from root hairs to the inner tissues.
Part - 5 : Function of Phloem :
(a) Conduction of food.
(b) Storage of organic food matters.
(c) Lateral translocation of food.
The phloem cells conduct prepared food made in the leaves to the storage regions.

74. Given diagram is of an experiment just at the start. Study the diagram carefully and then answer the question that follow :

- (i) What phenomenon is intended to be shown by this experiment ?
- (ii) Which limb of U tube contains more concentrated solution, A or B ?
- (iii) Why have the two kinds of molecules been shown in different sizes ?



- (iv) Why is the membrane separating the two solutions labelled as semipermeable membrane ?
- (v) Which limb of U tube is functionally comparable to the root hairs of a plant ?

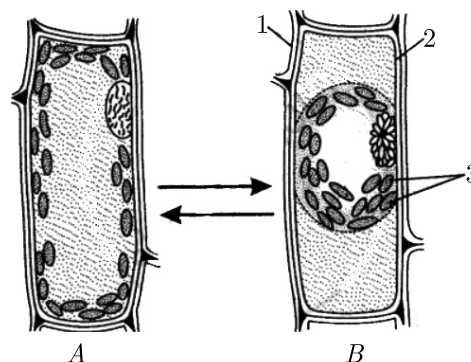
Ans :

SQP 2011

- (i) Osmosis
(ii) A
(iii) Their molecular sizes are different. Sucrose has large sized molecules.
(iv) It permits movement of only water molecules
Ans. to pass through it.

- (v) Limb A of U tube is comparable to the root hairs.

75. In the figures given below, 'A' shows a cell in the normal state and 'B' shows the same cell after leaving it in a certain solution for a few minutes :
- (i) Describe the change which has occurred in the cell as seen in B.
- (ii) Give the technical terms for the condition of the cell as reached in B and as it was in A.
- (iii) Define the process which led to this condition.
- (iv) Was the solution isotonic, hypotonic or hypertonic in which the cell was kept ?
- (v) How can the cell in 'B', be brought back to its original condition ?
- (vi) Name the parts numbered 1 to 3.

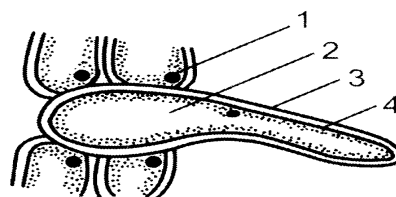


Ans :

COMP 2020

- (i) The protoplast shrinks and leaves the cell wall as it is plasmolysed.
- (ii) A - Flaccid
B - Turgid
- (iii) A cell when placed in hypertonic solution shrinks due to contraction of protoplast.
- (iv) It was Hypertonic solution in which the cell was kept.
- (v) Keep the cell in Hypotonic solution.
- (vi) 1. Cell wall
2. Cell membrane
3. Chloroplasts.

76. The given figure shows a root hair:



- (i) Label the parts 1 to 4.
(ii) What is the role of part 4?

- (iii) Why is the root hair one-celled?
 (iv) What will happen to the root hair if some fertilizer is added to the soil near the root hair?

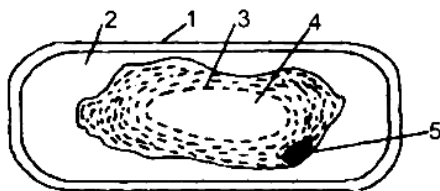
Ans :

SQP 2017

- (i) 1. Nucleus
 2. Vacuole,
 3. Cell wall
 4. Cell membrane
 (ii) Part 4 is cell membrane. It is semi-permeable in nature and it allows only certain substances dissolved in water to pass through it.
 (iii) It is an extension of epidermal cell.
 (iv) It becomes limp because water will move out, as soil water becomes hypertonic by the addition of fertilizer.

77. The diagram below represents a plant cell after being placed in a strong sugar solution. Guidelines 1 to 5 indicate the following :

1. Cell wall
 2. Strong sugar solution
 3. Protoplasm
 4. Large vacuole
 5. Nucleus.



Study the diagram and answer the questions that follow :

- (i) What is the state of the cell shown in the diagram ?
 (ii) Name the structure which acts as a selectively permeable membrane.
 (iii) If the cell had been placed in distilled water instead of strong sugar solution, which feature would not have been present ?
 (iv) If the cell in the diagram possessed chloroplasts, where would these be present ?
 (v) Name any one feature of this plant cell which is not present in animal cells.

Ans :

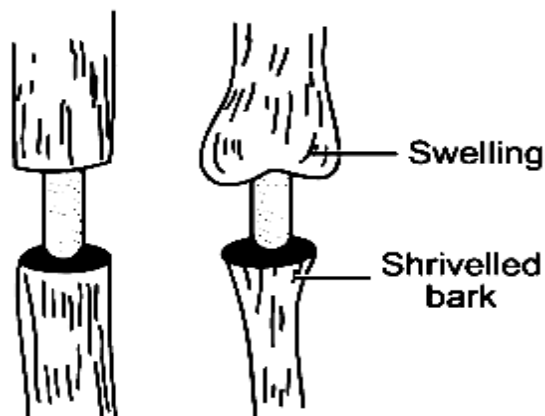
SQP 2004

- (i) Plasmolysed cell.
 (ii) Cell membrane.
 (iii) The membrane and cell wall cannot be distinguished from one another.
 (iv) The cytoplasm itself appears green due to the presence of chloroplast.

(v)

	Plant cell	Animal cell
(i)	Cell wall is present.	Cell wall is absent.
(ii)	Vacuole is large.	Vacuole is absent. Even if present, are small, temporary and are concerned with either excretion or secretion.
(iii)	Cytoplasm is pushed to the periphery region and forms a thin lining with the cell wall.	In an animal cell, the cytoplasm is denser, granular and occupies greater space in the cell.

78. The figure represents a tree in which a ring of bark was removed. After a season, a swelling appeared on the bark above the ring while the bark below shrivelled up.



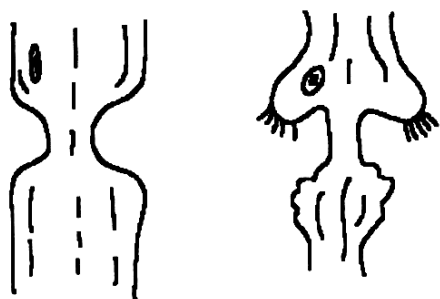
- (i) Account for the swelling in the bark above the ring.
 (ii) Account for the shrinking of the bark below the ring.
 (iii) Name the tissue that distributes food in plants.

Ans :

MAIN 2010

- (i) The swelling above the ring takes place due to the accumulation of food, because phloem takes the food till the part above the ring.
 (ii) The shrinkage of the bark below the ring takes place due to the absence of food as phloem has been removed and food does not reach the part below the ring.
 (iii) Phloem.

79. A complete ring of bark was removed from a tree as shown in the figure A. The tree continued to live and after about one month it appeared as B.



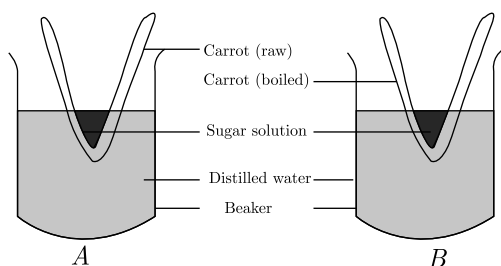
- Account for the swelling in the bark above the ring.
- Account for the shrinkage of the bark below the ring.
- Name the tissue that distributes food in plants.
- Name the tissue that distributes water in plants.

Ans :

MAIN 2017

- Due to removal of ring of bark the phloem was removed. Phloem conducts food from leaves to other parts of the plants. The food material gets accumulated at the cut site resulting in swelling.
- The part of the plant below the ring does not get food hence it shrinks.
- Phloem
- Xylem

80. The given figure is the diagrammatic representation of an experiment to demonstrate osmosis by carrot osmoscope:



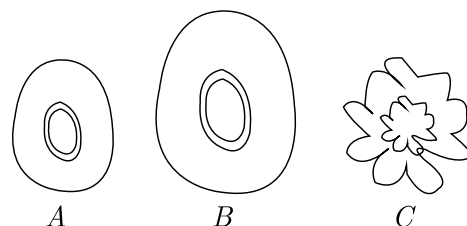
- What will happen in A and B after an hour or so?
- Give reason for the difference in observations made in A and B.
- What is the control experiment?
- What would happen if dilute sugar solution was placed inside the cavity of the carrot and strong sugar solution was kept in the beaker?

Ans :

SQP 2013

- After an hour or so in A, the level of sugar solution in the cavity of carrot will rise while in B no change will take place.
- The reason for the above change in A is that carrot is raw so it is semi-permeable membrane, living and osmosis takes place, while B, the carrot is boiled and is dead so plasma membrane loses its semi-permeability and osmosis does not take place.
- Control experiment is B with boiled carrot.
- Exosmosis will take place and the level of water in the beaker will increase.

81. The given figure shows the diagrammatic representation of an RBC kept in three different kinds of solutions:



- Name the three solutions in which the RBCs are kept.
- What changes take place to the RBCs after sometime?
- Give reasons for the changes.

Ans :

SQP 2018

- A – Isotonic solution
B – Hypotonic solution
C – Hypertonic solution
- In A – cell shape and size remain unchanged.
In B – cell enlarges or bursts.
In C – cell shrinks in size.
- A – Cell was kept in isotonic solution so no movement of water or solvent molecules.
B – Cell was kept in hypotonic solution so water enters into the cell and it enlarges.
C – Cell was kept in hypertonic solution so water moves out of the cell and gets shrunken.

82. A thin strip of epidermal cells of a leaf was observed in a drop of water. They all looked turgid and normal.

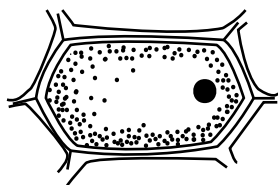
- Draw a diagram of such a cell.
- Draw the diagram of the cell if this strip is transferred to a strong concentrated solution of sugar.

- (iii) What will you do to bring these cells back to their original condition ?
 (iv) Name the condition observed in part (iii) above and then define it.

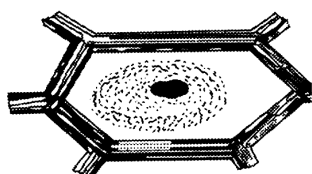
Ans :

SQP 2017

(i)



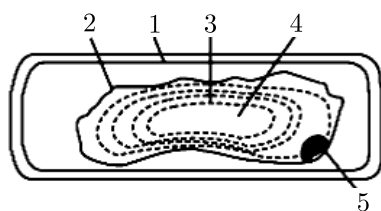
(ii)



- (iii) Keep these cells in water or hypotonic solution.
 (iv) Deplasmolysis.

The recovery of the protoplasm when a plasmolysed cell is placed in a hypotonic solution is called deplasmolysis.

- 83.** The figure represents a plant cell after being placed in a strong sugar solution.



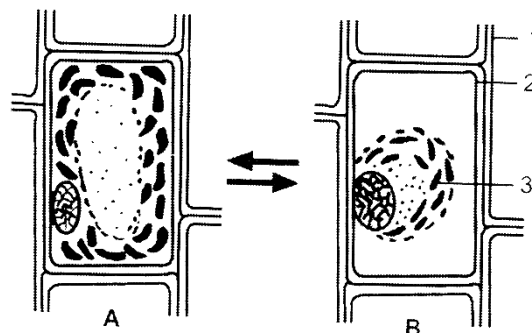
- (i) Label the parts 1 to 5.
 (ii) What is the state of cell shown in the figure ?
 (iii) Name the structure which acts as a semipermeable membrane.
 (iv) If the cell in diagram possessed chloroplasts, where would these be present ?

Ans :

MAIN 2021

- (i) 1 – Cell wall
 2 – Strong sugar solution
 3 – Protoplasm
 4 – Central Vacuole
 5 – Nucleus
 (ii) Plasmolysed
 (iii) Cell membrane
 (iv) Cytoplasm

- 84.** In the figure, A shows a cell in the normal state and B shows the same cell after leaving it in a certain solution for a few minutes:



- (i) Describe the change which has occurred in the cell as seen in B.
 (ii) Give the technical terms for the condition of the cell as seen in B and in A.
 (iii) Define the process which led to this condition.
 (iv) What was the solution – isotonic, hypotonic or hypertonic in which the cell was kept?
 (v) How can the cell in B be brought back to its original condition?
 (vi) Name the parts numbered 1 to 3.

Ans :

SQP 2011

- (i) The protoplast shrinks away from the cell wall due to plasmolysis.
 (ii) Flaccidity – figure B.
 Turgidity – figure A.
 (iii) When a cell is placed in a hypertonic solution, shrinkage of protoplasm occurs. This phenomenon is called plasmolysis.
 (iv) Hypertonic.
 (v) By keeping the cell in a hypotonic solution, the cell will restore back to its original structure.
 (vi) 1. Cell wall
 2. Cell membrane
 3. Chloroplast.

- 85.** The given diagram represents an experimental set-up to demonstrate a vital process. Study the same and then answer the questions that follow :

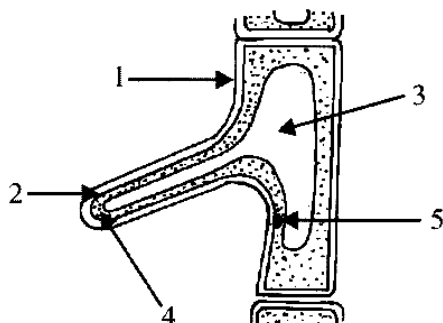
- (i) What would you observe in the experimental set-up after an hour or so ?
 (ii) What control experiment can be set-up for the above experiment ?
 (iii) Keeping in mind the root hair cell and its surrounding, name the part that corresponds to :
 (a) Concentrated sugar solution;
 (b) Parchment paper ;

- (c) Water in the beaker.
- (iv) Name any other substance that can be used instead of parchment paper in the above experiment.
- (v) Mention two advantages of this process to the plant.

Ans :

MAIN 2018

- (i) After an hour or so, the level of liquid in the vertical tube would rise.
- (ii) The control is to take water both in the vertical tube and in the beaker.
- (iii) (a) Cell sap
(b) Plasma membrane/Cell membrane
(c) Soil water.
- (iv) Goat's bladder, Visking's bag.
- (v) (a) Absorption of water by root hairs.
(b) To provide turgidity to cells.
86. (i) The given diagram is of a root hair. On the diagram, name the parts numbered 1 to 5.



- (ii) What role is played in the uptake of water into the root hair by the plants numbered 1, 2 and 3 ?
- (iii) What would happen if living cells of a plant were placed first in a strong solution of cane sugar and then in water ?
- (iv) Of what use is osmosis to the growing plant?

Ans :

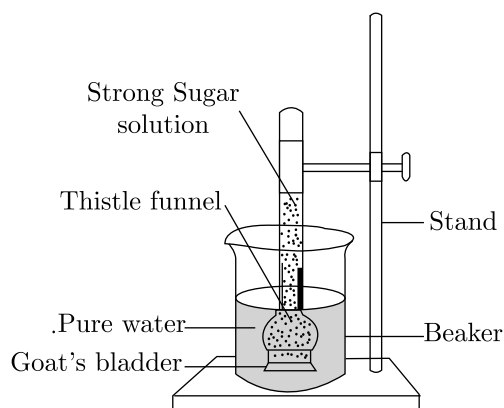
COMP 2019

- (i) 1. Cell wall
2. Cell membrane
3. Vacuole
4. Cytoplasm
5. Nucleus.
- (ii) 1. Cell wall : It is freely permeable.
2. Cell membrane: It allows only water to pass through. It is a semi-permeable membrane.
3. Vacuole : It contains cell sap. The concentration of cell sap is more than soil water. So, endosmosis takes place.

- (iii) If a cell is placed in a concentrated cane sugar solution, plasmolysis takes place. If the plasmolysed cell is placed in water, deplasmolysis takes place and the cell regains its state.
- (iv) Osmosis helps in the absorption of water by root hairs. This helps in equal distribution of water from one cell to other.

87. The apparatus shown was set up for an experiment. After some time the level of the liquid in the vertical section increased:

- (i) What process does the experiment demonstrate?
- (ii) Name two liquids that could be used in this experiment.
- (iii) Why did the level of the liquid in the vertical tube rise ?
- (iv) Explain how the process named in (i) affects a protozoan such as Amoeba.
- (v) Give one example in plants in which the above process occurs and what is the advantage of this to plants.

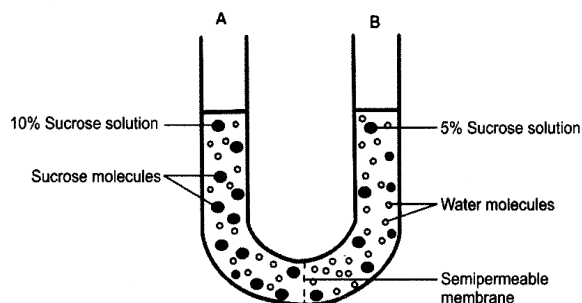


Ans :

SQP 2021

- (i) Osmosis.
- (ii) 1. Salt solution; 2. Water.
- (iii) The vertical tube contains sugar solution and is separated from pure water by a semi-permeable membrane. So, osmosis occurs and the level of the solution in the vertical tube rises.
- (iv) Amoeba is a unicellular organism and lives in water. It contains plasma membrane. So, osmosis takes place and water enters into the cell. To prevent the bursting of the cell, Amoeba possesses contractile vacuole that throws out unwanted substances.
- (v) Root hair – Osmosis helps in the absorption of water.

88. Given below is the diagram of an experiment just at the start. Study the diagram carefully and answer the following questions:

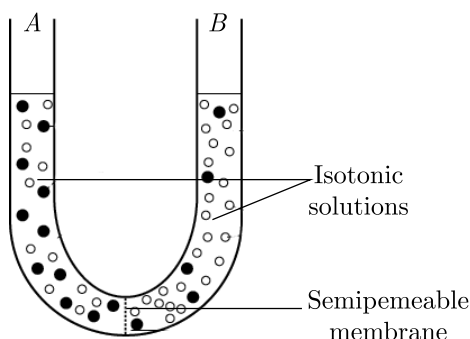


- What phenomenon is intended to be shown by this experiment?
- Which limb of the U-tube contains more concentrated sucrose solution – A or B?
- Why have the two kinds of molecules been shown in different sizes?
- Why is the membrane separating the two solutions labelled as semi-permeable membrane?
- Which limb of the U-tube (A or B) is functionally comparable to the root hairs of a plant?
- Redraw the diagram to show the result of the experiment after a few hours.

Ans :

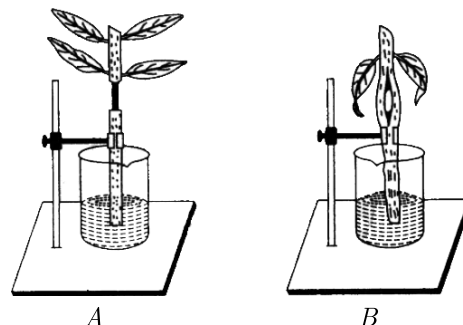
MAIN 2006

- Osmosis.
- Limb A in the U-tube has more concentration of sucrose solution.
- To represent solvent and solute particle: Bigger – Solute; Smaller – Solvent.
- The membrane separating the two solutions allows only solvent molecules to pass through it.
- Limb A is functionally comparable to the root hairs of a plant.
-



89. The given diagram represents the result of an experiment conducted on two freshly taken leafy shoots of a herbaceous plant. The lower ends of the shoots are dipped in ordinary water.

- What is the aim of the experiment?
- Some parts of the stem in both the shoots have been removed. Name the conducting tissue in shoot A and in shoot B that has been removed.
- What are the results of the experiment?



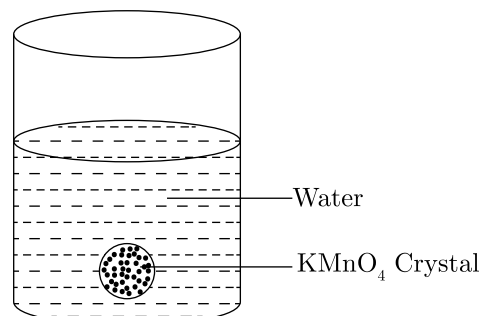
Ans :

COMP 2009

- The aim of the experiment is to show that conduction of water in plants takes place through xylem.
- In shoot A, phloem has been removed. In shoot B, xylem has been removed.
- In shoot B, xylem has been removed so the leaves show wilted appearance. But in shoot A, xylem has not been removed and the leaves show turgid appearance.

90. The given figure shows an experimental process:

- Name the process.
- Define the above mentioned process.
- What change will you observe after some time? Water
- Give one importance of this process to plants.



Ans :

SQP 2013

- Diffusion
- The movement of molecules of a substance

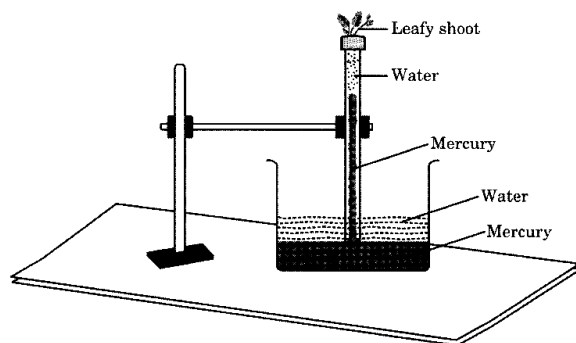
from their higher concentration to their lower concentration.

- (iii) The colour of water will change to purple because the molecules of KMnO_4 will evenly distribute among the empty space of water due to diffusion.
- (iv) Carbon dioxide and oxygen from the atmosphere diffuse through stoma.

91. Write an experiment to demonstrate transpiration pull.

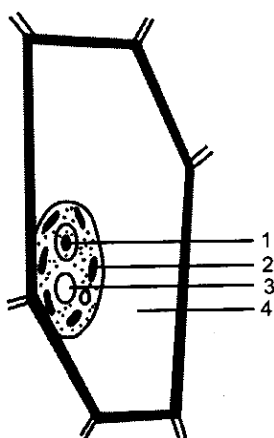
Ans :

SQP 2020



Fit a leafy shoot in a vertical tube filled with water. Keep the lower end of the tube in mercury. Keep the set-up undisturbed for sometime. It is seen that mercury will rise up in the vertical tube to a certain height due to transpiration pull.

92. Given below is the diagram of a cell as seen under the microscope after having been placed in a solution:



- (i) What is the technical term used for the state/condition of the cell given above ?
- (ii) Give the technical term for the solution in which the cell was placed.
- (iii) Name the parts numbered 1 to 4.

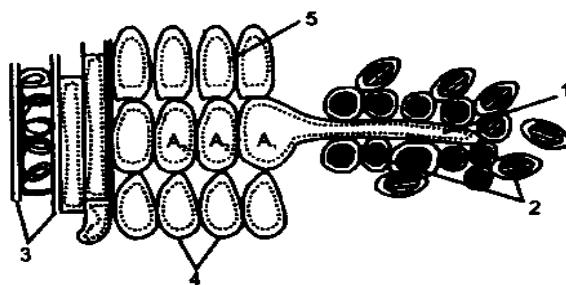
- (iv) Is the cell given above a plant cell or an animal cell? Give two reasons in support of your answer as evident from the diagram.
- (v) What would you do to bring this cell back to its original condition?

Ans :

MAIN 2015

- (i) Plasmolysis
- (ii) Hypertonic
- (iii) 1. Nucleus
2. Chloroplast,
3. Vacuole
4. Hypertonic solution
- (iv) Plant cell.
Reasons are:
1. presence of cell wall.
2. presence of chloroplast.
- (v) By keeping the cell in hypotonic solution and deplasmolyse it.

93. The figure given is a diagrammatic representation of a part of the cross-section of the root in the root hair zone. Study the same and then answer the questions that follow:



- (i) Name the parts indicated by guidelines '1' to '5'.
- (ii) Is the root hair cell unicellular or multicellular?
- (iii) Draw a labelled diagram of the root hair cell as it would appear if some fertilizer is added to the soil close to it.
- (iv) Name the process responsible for the entry of water molecules from the soil into A₁ and then into A₂.
- (v) What pressure is responsible for the movement of water in the direction indicated by arrows?
- (vi) How is this pressure set up?

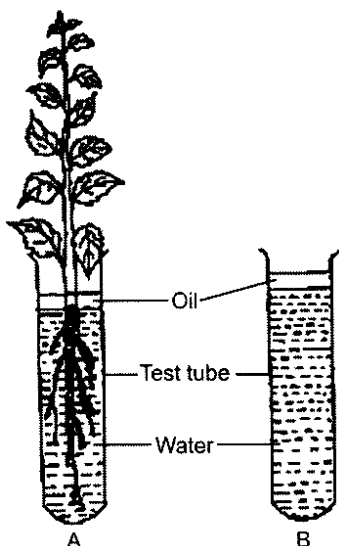
Ans :

MAIN 2007

- (i) 1. Root hair
2. Soil particles
3. Xylem
4. Cortical cells/Parenchyma cells/Cortex
5. Nucleus.
- (ii) Unicellular

- (iii) Diagram based questions
- (iv) Endosmosis (cell to A1), Osmosis (cell to cell A2).
- (v) Root pressure, Osmotic pressure.
- (vi) Due to the alternate turgidity and flaccidity of the root hair cell and the cortical cell, the pressure is maintained and water is sucked up. (cohesive and adhesive force)

94. Study the diagram given and answer the questions that follow:



- (i) Explain the physiological process being studied.
- (ii) What will be observed in the two test tubes after two to three days?
- (iii) Give a reason for your answer in (ii) above.
- (iv) Why is the surface of water covered with oil?
- (v) State the purpose of setting up test tube B.

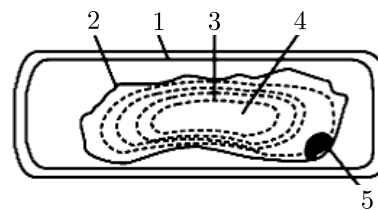
Ans :

SQP 2011

- (i) Absorption of water by the roots.
- (ii) After two days, it is seen in test tube 'A' the water level will fall and in test tube 'B' water level remains the same.
- (iii) In test tube 'A', the plant transpires and absorbs water, so water level falls whereas test tube 'B' acts as a control and no absorption takes place since plant is not kept in it.
- (iv) To prevent the evaporation of water.
- (v) Test tube 'B' acts as a 'control'.

95. The figure represents a plant cell after being placed in a strong sugar solution. Guidelines 1 to 5 indicate the following:

- 1. Cell wall; 2. Strong sugar solution; 3. Protoplasm; 4. Large vacuole; 5. Nucleus.



Study the diagram and answer the questions that follow:

- (i) What is the state of the cell shown in the diagram?
- (ii) Name the structure which acts as a selectively permeable membrane.
- (iii) If the cell had been placed in distilled water instead of strong sugar solution which feature would reappear.

Ans :

COMP 2010

- (i) It is a plasmolysed cell.
- (ii) Cell membrane acts as selectively permeable membrane.
- (iii) Large vacuole.

CASE BASED QUESTION

96. Ravi is studying how water and minerals affect plant growth in different soils. He observes healthier growth in plants with sufficient water and minerals compared to those in dry soils.

- 1. How is water involved in photosynthesis, and why is it essential for plants?
- 2. What is the role of mineral nutrients in plant growth?
- 3. How does water aid in transpiration, and why is it important for plant cooling?
- 4. What happens to plant cells when deprived of water, and how does it affect stomata?

Ans :

- 1. Water provides the electrons needed for photosynthesis and releases oxygen during the process.
- 2. Mineral nutrients help in growth and metabolism, absorbed by roots as ions.
- 3. Water is lost during transpiration, cooling the plant and aiding nutrient movement.
- 4. Without water, cells lose turgidity, causing stomata to close and reducing photosynthesis.

97. Sana is observing the impact of water and minerals on plant growth in her school garden. She notices

that well-watered plants with adequate minerals are taller and greener, while those lacking water or minerals show wilting and yellowing of leaves.

1. How does water contribute to the process of nutrient transport in plants?
2. What role do minerals play in the production of plant enzymes?
3. How does the lack of water affect the opening and closing of stomata?
4. What impact does a deficiency of minerals have on plant leaves?

Ans :

1. Transport
2. Enzymes
3. Closing
4. Yellowing

- 98.** A student, Ankit, is studying how different materials, such as seeds and wood, absorb water and increase in volume. He learns that this process is called imbibition, and it creates significant pressure as the materials swell.

1. What is the movement of water into substances like seeds called?
2. What happens to the volume of imbibants when they absorb water?
3. What is the pressure created during imbibition called?
4. Which substances are involved in the process of imbibition?

Ans :

1. Imbibition
2. Increases
3. Imbibitional pressure
4. Imbibants

- 99.** Meena is learning about how molecules move in her biology class. She observes that molecules move from an area of higher concentration to an area of lower concentration, a process called diffusion. This movement is driven by the kinetic energy of the molecules and continues until the concentration is equal throughout the space

1. What is the process of molecules moving from a higher to a lower concentration called?
2. What force drives the movement of molecules during diffusion?
3. When does the movement of molecules during diffusion stop?
4. How does diffusion help in the cell's protoplasm?

Ans ::

1. Diffusion
2. Kinetic energy
3. Equal concentration
4. Spreads molecules

- 100.** Aditi is studying the process of osmosis in her biology class. She learns that water molecules move from an area of higher concentration to lower concentration through a semipermeable membrane. She is also introduced to the concept of osmotic pressure and the different types of membranes involved in this process.

1. What is the movement of water molecules through a semipermeable membrane called?
2. What is the pressure required to prevent a solution from gaining more solvent molecules during osmosis?
3. Give an example of a semipermeable membrane.
4. What type of membrane is the cell membrane classified as?

Ans :

1. Osmosis
2. Osmotic pressure
3. Parchment paper
4. Differentially permeable

- 101.** Rohan is studying tonicity and how solute particles affect the tension in a system. He learns about three types of solutions: isotonic, hypotonic, and hypertonic and how they influence the movement of water in and out of cells.

1. What is the term for the tension developed in a system due to solute particles?
2. Name the type of solution where the concentration of solutes is the same inside and outside the cell.
3. What type of solution causes water to move into the cell, leading it to swell?
4. What type of solution causes water to leave the cell, making it

Ans :

1. Tonicity
2. Isotonic
3. Hypotonic
4. Hypertonic

- 102.** Suman is studying how water moves through plants. She learns that root pressure helps push water upward from the roots, and the process by which water and minerals are transported to

the aerial parts of the plant is called ascent of sap. This movement occurs through the xylem due to several forces, including root pressure and transpiration pull.

1. What is the pressure developed in roots to push sap upwards called?
2. What is the process of water transport from roots to aerial parts of the plant called?
3. Through which plant tissue does the ascent of sap occur?
4. Name one force responsible for the ascent of sap besides root pressure.

Ans :

1. Root pressure
2. Ascent of sap
3. Xylem
4. Transpiration pull

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CHAPTER 4

TRANSPIRATION

SUMMARY

Most of the water absorbed by the plants is lost by them in the form of vapours. Only a small fraction (about 2%) is used for the maintenance of their life. All these plants continuously absorb water through their roots. This water is conducted upward through stem and is distributed to all the aerial parts including the leaves.

1. TRANSPIRATION

It is a vital process both to plants and environment and consequently to humans. It creates suction force which helps in ascent of sap.

1.1 Types of Transpiration

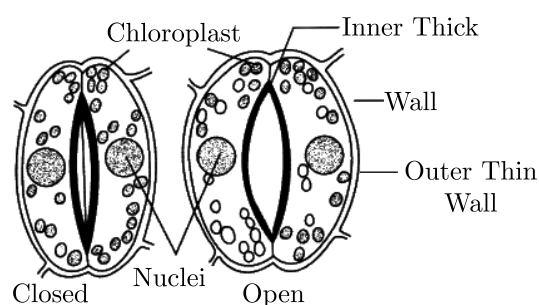
The following three types of transpiration are recognized in plants :

1. **Cuticular transpiration :** Cuticle is present on the epidermis of leaves and herbaceous stem. The loss of water in the form of vapours from epidermal cells of leaves and herbaceous stem is said to be cuticular transpiration.
2. **Lenticular transpiration :** Lenticels are present in the bark of woody (old) stem. These are permanent openings of plants. Transpiration occurring through these lenticels fall under this category.
3. **Stomatal transpiration :** The stomatas are present in the epidermis of leaves and green stems. The transpiration which takes place from the stomatas of the leaves of plants is called stomata transpiration.

2. STOMATA

These are minute pores in the epidermal layers of the aerial parts of plants. They are more abundant on leaves. A stoma is surrounded by two specialised epidermal cells called guard cells which are of two different shapes. One with kidney shaped (as in dicot leaves) and other dumb bell shaped (as in monocot leaves). Stomatas are called

as “Turgor operated valves”. Generally stomata are open during the day time and closed at night. But in succulents like cacti stomata closes during day and opens at night.



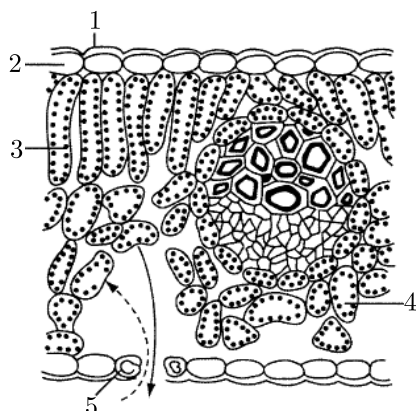
Close and Open Stomata

2.1 Mechanism of Stomatal Transpiration

The opening of stomata is governed by the changes in the turgor of the guard cells and the epidermal cells adjacent to the guard cells. Two important theories were put forward to explain the changes that occur in osmotic pressure of the guard cells. These theories are :

1. **Starch → Sugar interconversion theory:** Stomata open in light and close in dark. This is due to enzymatic conversion of starch into sugar in light. Sugar increases the osmotic concentration of cell sap of the guard cells with the result that they absorb more water from the neighbouring epidermal cells and increases turgidity of the guard cells which results in the opening of stomata. In dark, sugar is converted into starch and whole process is reversed leading to closure of stomata.
2. **Active potassium ion transport mechanism:** According to this view, accumulation of potassium ion in the guard cells (as occurs in light) increases negatively the osmotic potential of guard cells, causing stomata to open. In dark, potassium ion moves out of the guard cells and their osmotic potential becomes less negative. Thus, water moves

out of the guard cells and their turgidity decreases, causing closure of stomata.



1. Cuticle
2. Upper epidermis
3. Palisade tissue
4. Spongy parenchyma
5. Guard cell of stoma

2.2 Factors Affecting Transpiration

The Factors affecting transpiration are as follows.

(A) Internal Factors :

1. Leaf area – Larger surface area of leaves means more transpiration
2. Leaf structure – Presence of thick cuticle, coating of wax, sunken stomata, compact mesophyll and reduction in number of stomata reduce the rate of transpiration.
3. Rolling, twisting and curling – Reduces the rate of transpiration because the amount of radiation received by the leaf is decreased.
4. Mucilage or latex – Presence of mucilage and latex reduces the rate of transpiration.
5. Root shoot ratio – Rate of transpiration increases with the increase in root shoot ratio.

(B) External or Environmental Factors :

1. Light – Only up to a certain point, the increase in light intensity will increase the rate of transpiration.
2. Temperature – Transpiration increases with the rise in temperature.
3. Atmospheric humidity – Transpiration is greater, when humidity is low.
4. Wind – Increase in wind speed increases transpiration.
5. Atmospheric pressure – Transpiration rate increases with decrease in atmospheric pressure.

6. Carbon dioxide – Increase in concentration of carbon dioxide over the normal level (0.03%) causes stomatal closure hence decrease rate of transpiration.

2.3 Advantages of Transpiration

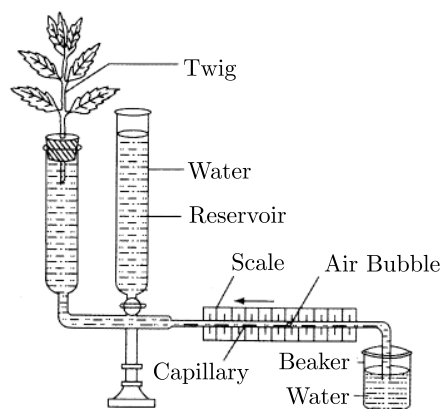
The advantages of transpiration are - Maintenance of turgidity, promotion of uptake and translocation of solutes, reduction of leaf temperature, absorption of water, cooling effect, improvement in the quality of fruits and hardening.

2.4 Disadvantages of Transpiration

The disadvantages of transpiration are – Wilting injury, stunted growth, abscission of leaves and expenditure of energy.

3. POTOMETER

A potometer is an apparatus designed to measure the rate of water uptake by a cut shoot or young seedling. It does not measure transpiration directly, but assumes that most of the water taken up by the plant is lost by transpiration. Several types of potometers are available but commonly Ganong's, Darwin's and Farmers potometers are used. In all these potometers an air bubble is introduced in the capillary through which water is absorbed. The rate of movement of bubble over a fixed distance is noted. The comparison of bubble movement under different conditions gives the rate of transpiration under different environmental conditions. To compare the rate of transpiration from both surfaces of a dorsiventral leaf (unequal transpiration) is measured by Ganong's potometer.



Ganong's Potometer

4. GUTTATION

It is the exudation of water drops from the edges

or tips of leaves through hydathodes. This occurs due to high root pressure and low temperature. It occurs in – garden nasturtium, colocasia, oats, tomato, potato, grass, sunflower, balsam, chrysanthemum, etc.

5. BLEEDING

It is the exudation of sap from injured parts of plants. It is also a manifestation of root pressure. If an incision is made in the stem of a plant growing in well watered soil, xylem sap starts oozing out due to root pressure. Exudation of milky latex in Calotropis and Euphorbia are the examples of bleeding.

MULTIPLE CHOICE QUESTION

- The process in which water is lost from the margins of strawberry leaves is:
 - Osmosis
 - Imbibition
 - Diffusion
 - Guttation

Ans :

MAIN 2024

Guttation is the exudation of water droplets from the margins or tips of leaves of some vascular plants. It typically occurs at night. Special pore-bearing structures called hydathodes present on the margins of the leaf allow this exudation. Thus (d) is correct option.

- Which one of the following helps In the opening of stomata:
 - Cobalt ions
 - Potassium ions
 - Magnesium ions
 - Aluminium ions

Ans :

MAIN 2024

Potassium ions (K^+) play a significant role in the regulation of stomatal opening and closing in plant cells. When potassium ions are actively pumped into guard cells, they cause an osmotic uptake of water, leading to increased turgor pressure within the guard cells. This increased pressure causes the guard cells to swell and the stomata pore to open, allowing for gas exchange and transpiration. Conversely, the loss of potassium ions from guard cells results in decreased turgor pressure, causing the stomata to close. Thus (b) is correct option.

- Permanently open structures seen on the barks of old woody stems :
 - Stomata
 - Hydathodes
 - Lenticels
 - Epidermal pores

Ans :

MAIN 2021

Permanently open structures seen on the bark of an old woody stem are called lenticels. Thus (c) is correct option.

- Transpiration is useful to the plant because it :
 - Creates a suction force for absorption of water from the soil
 - Helps in Photophosphorylation
 - Synthesises glucose
 - Splits water molecules.

Ans :

SQP 2021

A suction force is created by transpiration that helps in the upward movement of water in the plants. Certain hydrophilic salts are accumulated on the surface of the leaves, which keeps the leaves moist. It maintains the turgidity of the cells and helps in cell division. Thus (a) is correct option.

- Transpiration :
 - It is the loss of water in the form of droplets from the aerial parts of the plant.
 - It is the loss of water in the form of water vapour from the underground parts of the plant.
 - It is the loss of water in the form of water vapour from the aerial parts of the plant.
 - It is the loss of water in the form of water vapour from all parts of the plant.

Ans :

COMP 2021

In plants, the loss of water in the form of vapour is called transpiration. Thus (c) is correct option.

- Cuticle on leaves :
 - Prevents photosynthesis.
 - Reduces transpiration.
 - Protects leaves from grazing animals.
 - Gives colour to leaves.

Ans :

SQP 2021

The waxy coat present on both sides of the leaf surface is called the cuticle. Cuticles prevent plants from extreme climates like drought and save water. The transpiration through stomata

reduces due to cuticles.

Thus (b) is correct option.

7. Loss of water as droplets from hydathodes is called

(a) Transpiration (b) Bleeding
(c) Guttation (d) Evaporation

Ans :

MAIN 2010

Loss of water as droplets from hydathodes is called guttation.

Thus (c) is correct option.

8. Which one of the following does not affect the rate of transpiration?

(a) Light
(b) Humidity
(c) Wind
(d) Age of the plant

Ans :

SQP 2019

The rate of transpiration is affected by several factors temperature, humidity, wind speed and light intensity. Some internal factors also affect rate of transpiration e.g., leaf area, leaf structure and age of plants. Age of the plant is not a factor that affect transpiration.

Thus (b) is correct option.

9. Which of the following is not true for transpiration?

(a) It cools the plant
(b) Water lost has minerals
(c) Water is lost as vapours
(d) Maximum through stomata

Ans :

MAIN 2009

Mineral salts remain dissolved in the soil water and are absorbed by the roots. Minerals that are absorbed and accumulated in the xylem duct of the root move up and are distributed in the plant by the transpiration stream. It is not excreted during transpiration as in transpiration water loss happens in the form of vapour from the green plants.

Thus (b) is correct option.

10. With increase in atmospheric pressure, the rate of transpiration will.

(a) increase
(b) decrease
(c) remain steady
(d) slowly increase

Ans :

SQP 2005

Thus (b) is correct option.

11. On a dry, sunny day, how does water vapour move through the stomata of a leaf?

(a) Into the leaf by diffusion
(b) Into the leaf by respiration
(c) Out of the leaf by diffusion
(d) Out of the leaf by respiration

Ans :

MAIN 2015

Majority of the absorbed water is lost in form of vapour through the stomata of the leaf of plants.

This process is called transpiration in plants.

Thus (c) is correct option.

12. is the change observed in the indicator-dry cobalt chloride in the experimental set up after keeping it in the sunlight.

(a) No change (b) Red to Blue
(c) Blue to Pink (d) Pink to Blue

Ans :

MAIN 2023

Dry cobalt chloride paper that is blue in colour turns pink when it comes in contact with water.

Thus (b) is correct option.

13. Transpiration pull will be maximum under which condition?

(a) Open stomata, dry atmosphere and moist soil.
(b) Open stomata, dry atmosphere and dry soil.
(c) Open stomata, high humidity and moist soil.
(d) Open stomata, high humidity and less temperature.

Ans :

MAIN 2011

Transpiration pull will be maximum under open stomata, dry atmosphere and moist soil.

Thus (a) is correct option.

14. Most transpiration in herbaceous plant occurs through:

(a) Stomata (b) Lenticels
(c) Cuticle (d) Hydathodes

Ans :

COMP 2013

The loss of water through stomata (called stomatal transpiration) is the most common type of transpiration from plants.

Thus (a) is correct option.

15. From which part of a leaf does most water evaporate during transpiration?

(a) The cuticle
(b) The guard cells
(c) The spongy mesophyll cells
(d) The xylem vessels

Ans :

SQP 2014

Transpiration is the evaporation of water at the surfaces of the spongy mesophyll cells in leaves, followed by loss of water vapour through the stomata.

Thus (c) is correct option.

16. The rate of transpiration is more when:

- (a) Atmosphere is dry
- (b) Temperature is high
- (c) Atmosphere is dry and temperature is high
- (d) Humidity is high

Ans :

MAIN 2018

As the atmospheric temperature rises, the rate of transpiration also rises. With high temperature the water evaporates from the leaf surface quite rapidly. In dry and hot air the rate of transpiration rises further.

Thus (b) is correct option.

17. Forests contribute in bringing rain by

- (a) bleeding
- (b) transpiration
- (c) guttation
- (d) all of them

Ans :

COMP 2013

Trees release water vapour into the air in a process called transpiration. They release extra water in the form of water vapour from small holes of their leaves known as stomata, that water vapour rises in the atmosphere and form new rain clouds and that water vapour returns to earth in form of rain. Thus (b) is correct option.

18. Lenticels are present on:

- (a) Green stem
- (b) Woody stem
- (c) Leaves
- (d) Flowers

Ans :

MAIN 2004

Lenticels are raised pores in the stem of a woody plant that allows gas exchange between the atmosphere and the internal tissues.

Thus (b) is correct option.

19. What is a description of transpiration?

- (a) Exchange of gases between the leaf and the atmosphere.
- (b) Loss of water vapour from the leaves and stems of a plant.
- (c) Movement of water from the roots to the leaves.
- (d) Movement of water through the cells of the leaf.

Ans :

SQP 2002

Transpiration is the process of water movement through a plant and its evaporation from aerial parts, such as leaves, stems and flowers.

Thus (d) is correct option.

20. Given below is an example of a certain structure and its special functional activity. Which one of the following pair is incorrect?

- (a) Hydathodes ; Guttation
- (b) Stomata : Diffusion of gases
- (c) Leaf spines : Prevents transpiration by reducing leaf lamina
- (d) Lenticels : Diffusion of gases on the green stem

Ans :

SQP 2016

Lenticels are porous tissue consisting of cells with large intercellular spaces in the periderm of the secondarily thickened organs and the bark of woody stems and roots of dicotyledonous flowering plants.

Thus (d) is correct option.

21. Lenticels allow diffusion of gases for

- (a) Respiration
- (b) Transpiration
- (c) Photosynthesis
- (d) Both (a) and (c)

Ans :

MAIN 2020

Lenticels facilitate the gas exchange of oxygen, carbon dioxide, and water vapour in plant bodies that produce secondary growth. Thus, it helps in exchange of gases, both in respiration and photosynthesis.

Thus (d) is correct option.

22. Given below are the advantages of transpiration, except for

- (a) Cooling
- (b) Suction force
- (c) Distributing water
- (d) Provides oxygen

Ans :

SQP 2021

The process of transpiration helps in the exchange of gases; helps in sending out excessively absorbed water by plants; helps in the absorption and distribution of water in plants; and provides coolness to the plant body. It does not provide oxygen.

Thus (d) is correct option.

- 23.** Transpiration decreases with increase in
 (a) Temperature
 (b) Wind velocity
 (c) Atmospheric pressure
 (d) All of the above

Ans :

MAIN 2023

Atmospheric pressure affects transpiration, because it has influence on the rate of vaporization. When atmospheric pressure is high, the rate of transpiration is low.

Thus (c) is correct option.

- 24.** With respect to the Ganong's potometer, ... is incorrect.
 (a) Coloured water is used
 (b) Air bubble is introduced
 (c) Reading on the capillary tube indicates the volume of water lost.
 (d) None of the above

Ans :

SQP 2002

As the transpiration proceeds, i.e., as the water is lost from the twig, a suction force is set up which pulls the water from the beaker and the bubble in the capillary tube moves along. The readings on the capillary tube would give the volume of water lost in a given time.

Thus (c) is correct option.

- 25.** In a weighing experiment using a test-tube, we will to prevent evaporation.
 (a) Cover test tube with paper
 (b) Pouring oil on the surface
 (c) Cover it with polythene bag
 (d) Keep it in air-tight container

Ans :

COMP 2000

In a weighing experiment using a test-tube, pouring oil on the surface will prevent evaporation. Thus (b) is correct option.

- 26.** is observed in most evergreen trees.
 (a) Sunken stomata
 (b) Leaves covered by thick cuticle
 (c) Rolled leaves
 (d) Spines

Ans :

MAIN 2010

One of the most important adaptations of evergreen trees is the thick waxy cuticle that waterproof the leaves. The thick cuticle layer on the leaf surface slows the rate of transpiration.

Thus (b) is correct option.

- 27.** If the water content of the leaves decreases the rate of transpiration
 (a) Increases
 (b) Depends on other sector
 (c) Remains same
 (d) Decreases

Ans :

COMP 2019

If the water content of the leaves decreases, stomata will close because there will not be enough water to create pressure in the guard cells for stomatal opening. Due to this the rate of transpiration decreases and this response helps the plant to conserve water.

Thus (d) is correct option.

- 28.** The serves to prevent evaporation of water from the leaf surfaces.
 (a) Lenticels (b) Stomata
 (c) Cuticle (d) both (b) and (c)

Ans :

SQP 2011

A waxy layer known as the cuticle covers the leaves of all plant species. The cuticle reduces the rate of water loss from the leaf surface thereby preventing the evaporation of water from the leaf surfaces.

Thus (c) is correct option.

- 29.** More transpiration occurs from the of a leaf.
 (a) Dorsal surface (b) Under surface
 (c) Upper surface (d) both (a) and (b)

Ans :

SQP 2013

In all green plants transpiration occurs mostly through the stomata of the leaves. In dicot plants leaves will have more stomata on the lower surface than the upper surface. So more transpiration occurs through the lower surface of the leaves of this plant.

Thus (b) is correct option.

- 30.** Transpiration is the evaporative loss of water from
 (a) Roots
 (b) Leaves
 (c) Stem
 (d) Both (b) and (c)

Ans :

MAIN 2011

Transpiration is the process of release of water vapour from aerial parts, such as leaves, stems and flowers.

Thus (b) is correct option.

31. Desert plants tend to have
 (a) Thick cuticle (b) Thin cuticle
 (c) No cuticle (d) More stomata

Ans :

SQP 2013

Desert plants have a waxy cuticle layer on their leaves. This is an adaptation that helps keep water in the plant and reduce transpiration.

Thus (a) is correct option.

32. In a leaf, the cell sap in each cell exerts a outward on the cell wall.
 (a) Wall pressure
 (b) Turgor Pressure
 (c) Osmotic Pressure
 (d) Both (a) and (b)

Ans :

COMP 2023

The cell wall surrounds the plasma membrane of plant cells and provides tensile strength and protection against mechanical and osmotic stress. It also allows cells to develop turgor pressure, which is the pressure of the cell sap against the cell wall.

Thus (b) is correct option.

33. takes place directly from the surface of the leaves and stems.
 (a) Transpiration
 (b) Lenticular Transpiration
 (c) Stomata transpiration
 (d) Cuticular Transpiration

Ans :

SQP 2004

When loss of water occurs from the surface of leaves and herbaceous stem by direct evaporation from the epidermal cells through the cuticle, the process is cuticular transpiration.

Thus (d) is correct option.

34. If a plant is kept covered with a polythene sheet we notice some water drops on the inner side of the sheet after sometime. This is due to
 (a) Evaporation (b) Transpiration
 (c) Translation (d) Transportation

Ans :

MAIN 2017

As the potted plant covered with polythene bag is kept in the sunlight there will be the loss of water through the stomata present on the leaves. The water drops will appear inside the polythene bag as a result of a loss of water from the stomata. This is due to transpiration.

Thus (b) is correct option.

35. The water vapour diffuses through the air space between the mesophyll cells into the
 (a) Intercellular space
 (b) Stomata
 (c) Sub-stomatal space
 (d) Epidermis

Ans :

MAIN 2018

In plants, the transpiration stream is the uninterrupted stream of water and solutes which is taken up by the roots and transported via the xylem to the leaves where it evaporates into the sub-stomatal cavity. After this, the water leaves the leaf by diffusion through stomata.

Thus (c) is correct option.

36. The generated by a plant assists in bleeding.
 (a) Turgor Pressure
 (b) Suction force
 (c) Root Pressure
 (d) Capillarity

Ans :

SQP 2019

The root pressure generated by a plant forces the cell sap to rise through the stem. This causes bleeding or oozing of the cell sap from the cut surface of the plant.

Thus (c) is correct option.

37. The adaptation of in Nerium to reduce transpiration
 (a) Sunken stomata
 (b) Stomata covered by hairs
 (c) Folding of leaves
 (d) both (a) and (b)

Ans :

COMP 2003

Sunken stomata are present sunken in the leaf surface and usually surrounded by cuticles and hairs often referred to as trichomes in xerophytes like Nerium. It is an adaptive feature.

Thus (c) is correct option.

38. Each one of the following indicates a method used to measure the rate of transpiration except for
 (a) Weighing method
 (b) Potometer
 (c) Bell-jar experiment
 (d) Both (a) and (b)

Ans :

SQP 2010

A bell-jar experiment gives a visual proof of transpiration, it does not measure the rate of

transpiration.

Thus (c) is correct option.

- 39.** is used as an indicator for a demonstration of transpiration.

(a) Litmus paper
(b) Cobalt chloride paper
(c) Both (a) and (b)
(d) None of the above

Ans :

MAIN 2021

Dry cobalt chloride paper that is blue in colour turns pink when it comes in contact with water. Using this property of cobalt chloride paper we can demonstrate water loss during transpiration. Thus (b) is correct option.

- 40.** is a device which measures the rate of water intake by a plant.

(a) Manometer (b) Thermometer
(c) Potometer (d) Lactometer

Ans :

COMP 2023

A potometer, sometimes known as transpirometer, is a device used for measuring the rate of water uptake of a leafy shoot which is almost equal to the water lost through transpiration. Thus (c) is correct option.

- 41.** A plant with sunken stomata.

(a) Mango (b) Nerium
(c) Neem (d) Shrubs

Ans :

MAIN 2014

Plants growing mostly in xerophytic conditions have sunken stomata where they need to reduce transpiration rate. Some plants with sunken stomata are Nerium, Pine, Acacia, etc. Thus (b) is correct option.

- 42.** Exudation of sap from injured parts.

(a) Guttation
(b) Secretion
(c) Bleeding
(d) Active transport

Ans :

COMP 2010

Exudation of sap in plants through the injured part is called bleeding. It happens because of the hydrostatic pressure produced due to an accumulation of water in the root cells. Thus (c) is correct option.

- 43.** Leaf modification in cacti to check transpiration.

(a) Thorns (b) Phylloclade
(c) Prickles (d) Spines

Ans :

COMP 2012

The spines present on cacti represent the reduced leaves. The leaf parts become modified into spines in order to protect the plants from grazing animals and excessive transpiration.

Thus (d) is correct option.

- 44.** are minute openings in the epidermal layer of leaves.

(a) Lenticels (b) Cuticle
(c) Stomata (d) Stroma

Ans :

SQP 2017

Stomata are minute openings in the epidermal layer of leaves.

Thus (c) is correct option.

- 45.** The tissue that conducts water.

(a) Phloem
(b) Xylem
(c) Companion cells
(d) Transfusion tissue

Ans :

MAIN 2006

The tissue that conduct and transport water in plant body is xylem tissue.

Thus (b) is correct option.

- 46.** Lenticels

(a) They are present on the surface of leaves and stem.
(b) They are present on the surface of newly formed woody stem.
(c) They are present on the surface of older leaves and old woody stem.
(d) They are present on the surface of hard, old woody stem.

Ans :

COMP 2017

Lenticels are found as raised circular, oval, or elongated areas on stems and roots. In woody plants, lenticels commonly appear as rough, cork-like structures on young branches. Lenticels participate in gaseous exchange and transpiration. Thus (d) is correct option.

- 47.** Hydathodes

(a) Located along the margin and on the upper or lower surfaces of leaves.
(b) Located along the margin and on the upper or lower surfaces of leaves and green stem.
(c) Into pits on leaves margin which may be covered by multicellular hair.
(d) Present on the epidermis of herbaceous stem and leaves.

Ans :

SQP 2021

Hydathodes are the special pores in leaves through which guttation occurs. They are present below the guard cells as hydathodal space and are located in margin and tip of leaves in pant and grasses.

Thus (a) is correct option.

48. Guard cells

- (a) Regulate the closing of stomata
- (b) Regulate the opening and closing of stomata
- (c) Regulate the opening of stomata
- (d) Regulate the process of photosynthesis

Ans :

MAIN 2008

Guard cells are cells surrounding each stoma. They help to regulate the rate of transpiration by opening and closing the stomata.

Thus (b) is correct option.

49. Stomata:

- (a) Stomata help in diffusion of gases in the leaves and in transpiration.
- (b) Reduce the amount of water lost during transpiration
- (c) Regulate the opening and closing of guard cells
- (d) Reduce the intensity of incident light.

Ans :

COMP 2002

Their main function is to allow gases such as carbon dioxide, water vapor and oxygen to move rapidly into and out of the leaf.

Thus (a) is correct option.

50. Leaf spines

- (a) Prevents loss of water from the leaves due to evaporation.
- (b) Reduce the surface area so that the loss of water due to transpiration is reduced.
- (c) Causes the leaf to roll and prevent evaporation of water.
- (d) Allow for exchange of respiratory gases and prevent from browsing animals.

Ans :

SQP 2001

In certain plants such as cacti, entire or the parts of the leaves are modified into sharp and pointed structure called as leaf spines. It can act as defensive structure since it can protect the plants against grazing animals. It also reduces transpiration.

Thus (b) is correct option.

51. Bleeding

- (a) It is a natural process that takes place through cut/ ruptured surface of the plant.
- (b) Loss of water from the uninjured part or leaves of the plant in the form of water.
- (c) Natural process that takes place through the margins of the plant surface.
- (d) The diffusion of water vapour from the surface of the cell into the outside atmosphere.

Ans :

MAIN 2013

The exudation of liquid from the cut or injured surface of plants, such as date palm and Palmyra palm is known as bleeding. The root pressure generated by a plant forces the cell sap to rise through the stem. This causes bleeding or oozing of the cell sap from the cut surface of the plant.

Thus (a) is correct option.

52. Guttation

- (a) The loss of water in the form of water droplets from the surface of the leaf.
- (b) The loss of water in the form of water droplets through the stomata.
- (c) The loss of water in the form of water vapour along the leaf margin.
- (d) The loss of water in the form of water droplets along the leaf margin.

Ans :

SQP 2007

Guttation is the exudation of drops of xylem sap on the tips or edges of leaves of some vascular plants, such as grasses. Water exudes through specialised pores at the tips and the vein endings (margins) of the leaves called hydathodes.

Thus (d) is correct option.

53. Transpiration.

- (a) It is the loss of water as water vapour from the aerial parts/stems and leaves of the plants.
- (b) The process of removal of water as water droplets from the aerial parts/leaf/stomata of a plant.
- (c) Exudation of sap from injured parts of a plant.
- (d) The loss of water in the form of water vapour from the surface of the leaf only.

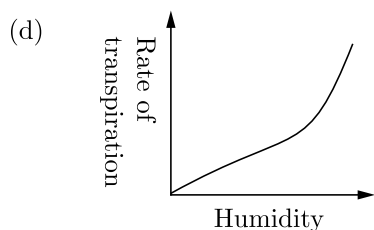
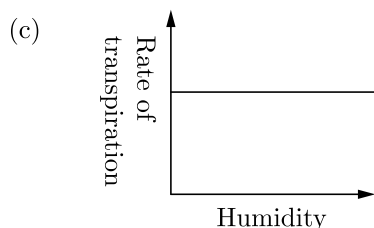
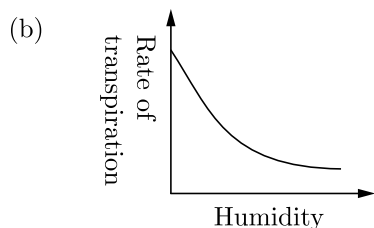
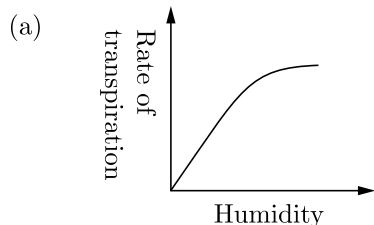
Ans :

MAIN 2011

Transpiration is the biological process by which water is lost in the form of water vapour from the aerial parts of the plants.

Thus (a) is correct option.

54. Which graph shows most clearly what will happen to the rate of transpiration as humidity increases?



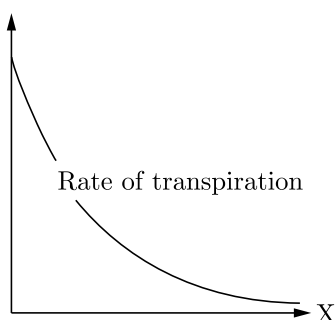
Ans :

SQP 2006

Transpiration is reduced if the air outside is humid. High humidity in the air reduces the rate of outward diffusion of the internal water vapour across stomata, thereby reducing the rate of transpiration.

Thus (b) is correct option.

55. The graph shows how the rate of transpiration is affected by X.



What is X?

- (a) Humidity (b) Light intensity
(c) Soil moisture (d) Temperature

Ans :

SQP 2002

Increased humidity has a reduced transpiration. If there is greater humidity, the surfaces of plants lose less water by evaporation, which lowers the demand for water from the roots.

Thus (a) is correct option.

56. A plant shoot is placed in a solution of a dye. The dye moves up the stem. Under which conditions will the dye move slowest?

	Temperature	Humidity
(a)	high	high
(b)	high	low
(c)	low	low
(d)	low	high

Ans :

MAIN 2018

Increased humidity and low temperature reduces the rate of transpiration.

Thus (d) is correct option.

57. During an experiment, a student notices certain cells regulating gas exchange on the leaf surface. Mention the exact location of Guard Cells :

- (a) Around the root hairs.
(b) Around the lenticels.
(c) Around the thylakoids.
(d) Around the stoma.

Ans :

SQP 2021

Guard cells are surrounded by stomatal pores and are located in leaf epidermis.

Thus (d) is correct option.

58. A researcher is studying water loss in different parts of a plant and observes that the majority of water loss occurs through tiny pores on the leaf surface. Which structure is responsible for maximum transpiration?

- (a) Lenticle
(b) Stomata
(c) Cuticle
(d) Root surface

Ans :

COMP 2002

Maximum transpiration occurs through stomata. Thus (b) is correct option.

- 59.** A farmer notices that the rate of transpiration in plants is increasing on certain days, even when other factors remain constant. Which environmental factor's decrease is likely causing this rise in transpiration?

(a) Humidity
(b) Light intensity
(c) Stomatal opening
(d) Temperature

Ans :

COMP 2019

When the light intensity is reduced the stomata are partially closed and the transpiration is reduced.

Thus (a) is correct option.

- 60.** A botanist is conducting an experiment to measure the factors influencing transpiration in plants. Which of the following factors is least likely to affect the rate of transpiration?

(a) Humidity of the atmosphere
(b) Number of open stomata
(c) Rate of respiration
(d) Temperature

Ans :

COMP 2020

The rate of transpiration is affected by several factors temperature, humidity, wind speed and light intensity. Some internal factors also affect rate of transpiration e.g., leaf area, leaf structure and age of plants. Rate of respiration will not affect the rate of transpiration.

Thus (c) is correct option.

- 61.** A gardener observes that the plants lose water faster on windy days compared to calm ones. Which factor is most likely responsible for the increased rate of transpiration?

(a) Increase in humidity
(b) Increase in wind velocity
(c) Reduced light intensity
(d) Increase in the CO_2 level

Ans :

MAIN 2016

At high wind velocity and high temperature, the rate of transpiration is increased but subsequently with very high temperature stomata is closed due to loss of turgor in guard cells.

Thus (b) is correct option.

- 62.** A farmer notices that his crops are drying out quickly under certain weather conditions. Under which type of weather would the transpiration rate be the fastest?

(a) hot, dry and windy
(b) hot, humid and cool wind
(c) humid and windy
(d) hot, humid and no wind

Ans :

SQP 2009

Transpiration will be fastest when the day is hot, dry and windy.

Thus (a) is correct option.

- 63.** A botanist is studying how different seasons affect water loss in plants. During which season is transpiration likely to be the highest?

(a) Rainy season (b) Winter
(c) Summer (d) Autumn

Ans :

MAIN 2003

Rate of transpiration is decided by the vapour pressure gradient between internal environment of leaf and atmosphere. Thus, rate of transpiration will be more during summers when atmospheric humidity is the least.

Thus (c) is correct option.

- 64.** During an experiment, a student observes that certain cells play a key role in regulating the opening and closing of stomata. Which cells are primarily responsible for this process?

(a) Epidermal cells
(b) Mesophyll cells
(c) Guard cells
(d) Both (a) and (b)

Ans :

SQP 2003

The opening and closing of stomata is controlled by the guard cells. When water flows into the guard cells, they swell up and the curved surface causes the stomata to open. When the guard cells loses water, they shrink and become flaccid and straight thus closing the stomata.

Thus (c) is correct option.

- 65.** A researcher is investigating various environmental factors that influence the rate of transpiration in plants. Which factor is least likely to affect the rate of transpiration?

(a) Intensity of light (b) Velocity of wind
(c) Carbon dioxide (d) Oxygen

Ans :

SQP 2020

Intensity of light, Temperature, Humidity, Wind velocity and Carbon dioxide concentration are the factors that affect transpiration.

Thus (d) is correct option.

66. A plant physiologist notices droplets of water at the tips of leaves in the early morning, a process known as guttation. Through which special pores does this process occur?.

(a) Hydathodes
(b) Lenticels
(c) Stomata
(d) Cuticle

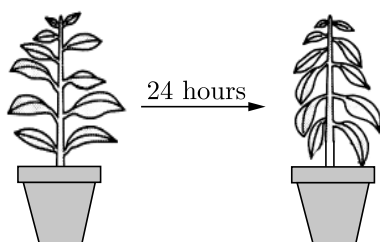
Ans :

SQP 2006

Hydathodes are special pores present on the ends of leaf veins through which guttation occurs and water droplets are given out.

Thus (a) is correct option.

67. The diagram shows a potted plant and the same plant 24 hours later.



What causes the change in the appearance of the plant?

(a) Water loss is greater than water uptake
(b) Water moves from the leaves to the stem
(c) Water uptake is equal to water loss
(d) Water uptake is greater than water loss

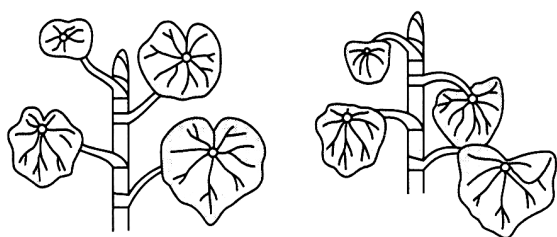
Ans :

COMP 2020

The wilting condition is found when plant tissues contain insufficient water to hold the cells rigid. This may occur when the rate of transpiration exceeds the rate at which water is able to enter the root system from a soil containing ample water or due to a deficiency of water in the soil.

Thus (a) is correct option.

68. The diagram shows a plant shoot and the same shoot five hours later.



Which change in environmental conditions could cause this change in the shoot?

(a) A decrease in available water
(b) A decrease in light intensity
(c) A decrease in wind speed
(d) An increase in humidity

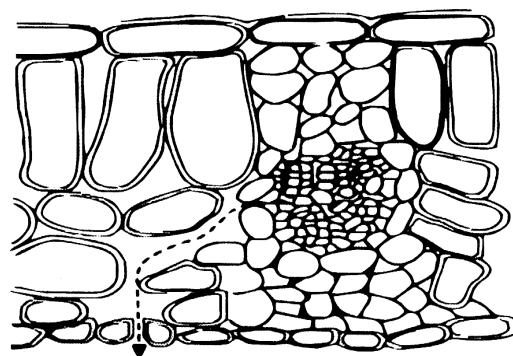
Ans :

SQP 2023

Too little water available to the plant combined with the usual transpiration will eventually cause the plant to wilt.

Thus (a) is correct option.

69. The diagram below shows part of a section through a leaf during day time.



What substance follows the path of the arrow out of the leaf?

(a) Carbon dioxide (b) Energy
(c) Oxygen (d) Water

Ans :

MAIN 2017

Water, after absorption by the roots from the soil, rises up through the xylem in the stem and reaches the spongy mesophyll cells in the leaves. The water then evaporates and saturates the air in the intercellular spaces which then diffuses to the outside through the stomata.

Thus (d) is correct option.

70. A student is investigating the effect of temperature on the rate of transpiration. Which environmental conditions should be kept constant during this investigation?

	Wind Speed	Light intensity	Humidity	Temperature
(a)	✓	✓	✓	✓
(b)	✓	✓	✓	×
(c)	✓	✓	×	×
(d)	×	×	×	✓

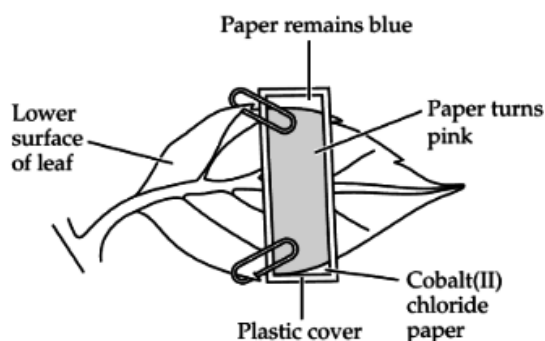
Ans :

COMP 2010

The rate of transpiration is affected by several factors, including : temperature, humidity, wind speed and light intensity. To investigate the effect of temperature on the rate of transpiration, other factors such as temperature, humidity, wind speed and light intensity should be kept constant.

Thus (b) is correct option.

71. A piece of blue cobalt chloride paper is clipped to the lower surface of a fresh leaf and is then covered with plastic as shown. After a few minutes, part of the paper turns pink, showing that water is present.



Which process carried out by leaves causes the paper to turn pink?

- (a) Absorption (b) Photosynthesis
(c) Respiration (d) Transpiration

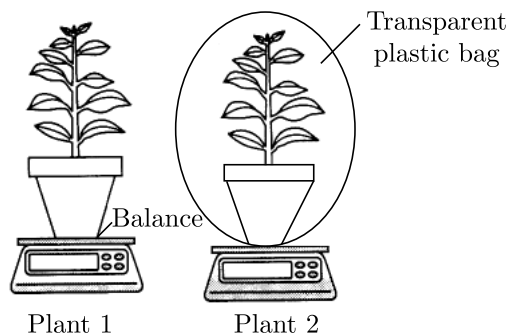
Ans :

MAIN 2001

Cobalt chloride paper is an indicator of moisture. It is blue when dry and pink when exposed to moisture. The initial blue cobalt chloride paper will turn pink only in the case of transpiration in which water vapour is released.

Thus (d) is correct option.

72. The diagram shows an experiment to investigate transpiration.



Plant 1 is not covered. Plant 2 and its pot are covered by a transparent plastic bag. The mass of each plant and its pot is measured. The masses

are measured again after two hours. What is the result?

- (a) The mass of both plants decreases by the same percentage.
(b) The mass of both plants stays the same.
(c) The mass of plant 1 decreases more than the mass of plant 2.
(d) The mass of plant 2 decreases more than the mass of plant 1.

Ans :

MAIN 2008

The loss in weight by the plant during the same time will be more in the case of plant 1 due to the loss of water by transpiration.

Thus (c) is correct option.

73. The diagram shows how water is lost from a leaf.



By which process is the water lost?

- (a) Osmosis (b) Photosynthesis
(c) Translocation (d) Transpiration

Ans :

SQP 2004

Transpiration is the process of water movement through a plant and its evaporation from aerial parts, such as leaves, stems and flowers.

Thus (d) is correct option.

DIRECTION : Matching Type Question

74. Priya is studying factors affecting transpiration. She matched the following factors with their effects on the rate of transpiration:

Factor	Effect on Transpiration
P	Increases transpiration when wind speed increases
Q	Decreases transpiration when humidity is high

Identify the correct pair of factors:

- (a) P – Light intensity, Q – Temperature
(b) P – Wind, Q – Humidity
(c) P – Humidity, Q – Carbon dioxide
(d) P – Wind, Q – Carbon dioxide

Ans :

Wind increases the rate of transpiration by removing the water vapor around the leaf surface, enhancing water loss. On the other hand, high humidity reduces the rate of transpiration because the air is already saturated with moisture, making it harder for water to evaporate from the leaves. Thus (b) is correct option.

75. Priya learned about different theories explaining stomatal movement. She summarized the following:

Theory	Explanation
P	Starch is converted to sugar in light to open stomata
Q	Potassium ion accumulation causes stomata to open in light

Identify the correct pair of theories:

- (a) P – Active potassium ion transport, Q – Starch-sugar interconversion
 (b) P – Starch-sugar interconversion, Q – Active potassium ion transport
 (c) P – Cuticular transpiration, Q – Lenticular transpiration
 (d) P – Guard cell transport theory, Q – Water absorption theory

Ans :

The starch-sugar interconversion theory explains that stomata open in light due to the enzymatic conversion of starch into sugar, increasing osmotic concentration and water absorption. The active potassium ion transport theory states that potassium ions accumulate in guard cells in light, decreasing their osmotic potential and causing the stomata to open.

Thus (b) is correct option.

76. Priya matched the factors affecting the internal control of transpiration in plants. She tabulated the following:

Factor	Effect on Transpiration
P	Larger leaf surface area increases transpiration
Q	Thick cuticle reduces transpiration

Identify the correct pair of factors:

- (a) P – Leaf structure, Q – Leaf area
 (b) P – Leaf area, Q – Leaf structure
 (c) P – Root shoot ratio, Q – Atmospheric humidity
 (d) P – Temperature, Q – Light intensity

Ans :

A larger leaf surface area exposes more stomata to the air, leading to higher water loss through transpiration. A thick cuticle, which is part of the leaf structure, serves as a protective barrier and reduces water loss, thereby lowering the transpiration rate.

Thus (b) is correct option.

77. Priya tried to match the advantages of transpiration with their effects on the plant. She tabulated the following:

Advantage	Effect on the plant
P	Maintains turgidity of plant cells
Q	Promotes the uptake and translocation of solutes

Identify the correct pair of advantages:

- (a) P – Cooling effect, Q – Absorption of water
 (b) P – Hardening, Q – Improvement of fruit quality
 (c) P – Maintenance of turgidity, Q – Promotion of solute uptake
 (d) P – Leaf abscission, Q – Wilting injury

Ans :

Transpiration helps in maintaining the turgidity of cells, which is important for structural support in plants. It also promotes the uptake and translocation of essential solutes from the soil to different parts of the plant through the transpiration stream.

Thus (c) is correct option.

78. Priya is studying guttation in plants. She matched the plant examples with the process of guttation as follows:

Plant	Process observed
P	Water droplets exude from the tips of leaves through hydathodes
Q	Exudation of sap from injured parts of plants

Identify the correct pair of plants:

- (a) P – Chrysanthemum, Q – Euphorbia
 (b) P – Garden nasturtium, Q – Colocasia
 (c) P – Potato, Q – Tomato
 (d) P – Sunflower, Q – Balsam

Ans :

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

COMP 2002

Light has indirect effect on the rate of transpiration. It affects the rate in two ways: firstly by controlling the stomatal opening and secondly by affecting the temperature. With the increase in the light intensity the rate of transpiration increases because the stomata get opened and the temperature increases. The rate of transpiration increases markedly in light and decreases in dark. There is a close relationship between the opening of stomata and presence of light.

Thus (a) is correct option.

- 89. Assertion:** Deciduous trees have to shed their leaves during autumn.

Reason: This is an adaptation to check loss of water by transpiration.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

MAIN 2000

Most deciduous trees lose their leaves to avoid excessive loss of water through transpiration. The new leaves are formed during the next suitable growing season. Trees shed their leaves in the dry season to conserve water for transpiration because in dry season there is scarcity of water.

Thus (a) is correct option.

- 90. Assertion:** Transpiration is a necessary evil.

Reason: It causes water loss but helps in absorption and upward movement of water and minerals.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

SQP 2019

Transpiration is essential for the movement of water and minerals from the root to the healthy parts of the plant. But excess transpiration may result in drying up of the leaves or wilting and loss of soil water. Hence, it is termed as a necessary evil.

Thus (a) is correct option.

- 91. Assertion:** Stomata remain open during the day time.

Reason: Stomata helps in exchange of gases.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

MAIN 2007

Stomata are open during the day because this is when photosynthesis typically occurs. Opening and closing of stomata occur due to turgor changes in guard cells. Stomata are chiefly concerned with gaseous exchange during photosynthesis and respiration and water loss through transpiration. Thus (b) is correct option.

- 92. Assertion:** The potometer does not measure the transpiration rate accurately.

Reason: Potometer usually measures the rate of water uptake.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

SQP 2011

The potometer does not measure the transpiration rate accurately because not all the water taken up by the plant is used for transpiration. A potometer can be used to measure the rate of transpiration that's proportional to water uptake.

Thus (b) is correct option.

- 93. Assertion:** Lenticels functions as a pore, providing a pathway for the direct exchange of gases between the internal tissues and atmosphere through the bark.

Reason: Lenticular transpiration amounts to 10% of the total transpiration.

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83. A teacher asked her students to name the apparatus used to measure the rate of transpiration.

Raj said: Potometer.

Sonu said: Hygrometer.

Lata said: Anemometer.

Abhay said: Barometer.

Who is correct?

- (a) Raj
- (b) Sonu
- (c) Lata
- (d) Abhay

Ans :

The potometer is an apparatus used to measure the rate of water uptake by a plant, which indirectly measures transpiration. Hygrometers measure humidity, anemometers measure wind speed, and barometers measure atmospheric pressure.

Thus (a) is correct option.

ASSERTION AND REASON

84. **Assertion:** Transpiration cools the plant.

Reason: Evaporation of water vapours reduces the temperature of the leaf surface.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

COMP 2021

Evaporation of water vapours reduces the temperature of the leaf surface as the latent heat required to convert water into water vapours is taken from the plant body, thereby lowering the temperature. Hence, both assertion and reason are true and reason is the correct explanation of assertion.

Thus (a) is correct option.

85. **Assertion:** Leaves are reduced to spines in cactus.

Reason: Leaves are modified to form spines to reduce the leaf lamina.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

- (c) If assertion is true but reason is false.

- (d) If both assertion and reason are false.

Ans :

SQP 2023

Reduced surface area reduce the loss of water by transpiration. Hence, both assertion and reason are true and reason is the correct explanation of assertion.

Thus (a) is correct option.

86. **Assertion:** In hot summer months most herbaceous plants wilt at noon and recover in the evening.

Reason: Plant shows wilting due to loss of turgidity.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

MAIN 2015

Loss of water from leaves, by transpiration far exceeds the absorption of water by the roots. Thus, the plant shows wilting due to loss of turgidity.

Thus (a) is correct option.

87. **Assertion:** Transpiration occurs through stomata

Reason: Guttation is due to root pressure.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If both assertion and reason are false.

Ans :

SQP 2001

Transpiration is the process of water movement through a plant and its evaporation from aerial parts, such as leaves, stems and flowers. It occurs mostly at the leaves through the minute openings present on the leaves called stomata. Hence, Assertion is correct. At night in some plants, root pressure causes guttation or exudation of drops of xylem sap from the tips or edges of leaves. Thus, guttation is due to root pressure.

Thus (b) is correct option.

88. **Assertion:** Light is one of the important factor in transpiration.

Reason: Transpiration increases in light and decreases in dark.

Guttation is the process where water droplets are exuded from the tips of leaves through specialized pores called hydathodes, as seen in plants like Chrysanthemum. Bleeding is the exudation of sap from injured plant parts, and this can be observed in Euphorbia, where latex or sap flows due to root pressure.

Thus (a) is correct option.

DIRECTION : Conversation Based Question

- 79.** A biology teacher asked her students to explain what regulates the opening and closing of stomata in plants.

Raj said: Guard cells regulate stomatal opening by controlling water movement.

Sonu said: Epidermal cells control the stomata directly.

Lata said: Guard cells regulate the opening and closing based on light.

Abhay said: Guard cells use potassium ions to regulate stomatal movement.

Who gave the correct explanation?

- (a) Raj and Lata
- (b) Sonu and Lata
- (c) Raj and Abhay
- (d) Abhay and Lata

Ans :

The guard cells regulate the opening and closing of stomata by controlling water movement and potassium ions. This process is influenced by environmental factors such as light, but epidermal cells are not directly responsible for this regulation. Thus (c) is correct option.

- 80.** A teacher asked her students to list factors affecting the rate of transpiration in plants.

Raj said: Increase in temperature and decrease in humidity increases transpiration.

Sonu said: High atmospheric pressure increases transpiration.

Lata said: Strong wind and sunlight increase the rate of transpiration.

Abhay said: Increase in humidity increases transpiration.

Who gave the correct explanations?

- (a) Raj and Lata
- (b) Sonu and Abhay
- (c) Lata and Abhay
- (d) Raj and Abhay

Ans :

Increase in temperature, decrease in humidity, strong wind, and sunlight all increase the rate of transpiration. However, high atmospheric pressure reduces the transpiration rate, and high humidity reduces water loss.

Thus (a) is correct option.

- 81.** A biology teacher asked her students to identify the two major types of transpiration in plants.

Raj said: Lenticular transpiration and Cuticular transpiration.

Sonu said: Stomatal transpiration and Cuticular transpiration.

Lata said: Stomatal transpiration and Guttation.

Abhay said: Lenticular transpiration and Stomatal transpiration.

Who gave the correct response?

- (a) Sonu and Abhay
- (b) Raj and Lata
- (c) Sonu and Lata
- (d) Sonu and Abhay

Ans :

The two major types of transpiration in plants are stomatal transpiration (which accounts for most water loss) and lenticular transpiration. Cuticular transpiration also occurs, but guttation is not considered transpiration.

Thus (d) is correct option.

- 82.** A biology teacher asked her students to explain the difference between transpiration and guttation.

Raj said: Transpiration is the loss of water as vapor, while guttation is the loss of liquid water.

Sonu said: Both transpiration and guttation occur during the night.

Lata said: Guttation occurs through lenticels, while transpiration occurs through stomata.

Abhay said: Transpiration and guttation both help cool the plant.

Who provided the correct explanation?

- (a) Raj and Lata
- (b) Raj and Abhay
- (c) Sonu and Lata
- (d) Raj and Sonu

Ans :

Transpiration involves the loss of water vapor through stomata, while guttation involves the loss of liquid water through hydathodes. Both processes can help cool the plant, but transpiration occurs during the day, and guttation often happens at night due to root pressure.

Thus (b) is correct option.

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
 (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.
 (c) If assertion is true but reason is false.
 (d) If both assertion and reason are false.

Ans :

MAIN 2013

Lenticels are porous tissue consisting of cells with large intercellular spaces in the periderm of the secondarily thickened organs and the bark of woody stems and roots of dicots. It functions as a pore, providing a pathway for the direct exchange of gases between the internal tissues and atmosphere through the bark, which is otherwise impermeable to gases. The loss of water from lenticels is very insignificant as it amounts to only 0.1% of the total.

Thus (c) is correct option.

DIRECTION : Match the following :

94. Match the items of Column A with those in Column B and select the correct option:

	Column I		Column II
(A)	Lenticels	(i)	An indicator of moisture
(B)	Cobalt chloride	(ii)	Sunken stomata paper
(C)	Nerium	(iii)	Minute openings on the woody stems
(D)	Guard cells	(iv)	Kidney shaped cells that surround the stoma

- (a) (A) - (ii), (B) - (i), (C) - (iii), (D) - (iv)
 (b) (A) - (iii), (B) - (ii), (C) - (i), (D) - (iv)
 (c) (A) - (ii), (B) - (iii), (C) - (ii), (D) - (iv)
 (d) (A) - (i), (B) - (iii), (C) - (ii), (D) - (iv)

Ans :

SQP 2004

Lenticels are the minute openings on the stem of a woody plant that allows gas exchange between the atmosphere and the internal tissues. Cobalt chloride paper is used as an indicator of moisture. Nerium is a xerophyte, it has sunken stomata to curtail the water loss by transpiration. Guard cells are specialized plant cells in the epidermis of leaves, stems and other organs that are used to control gas exchange. They are kidney shaped

cells that surround the stoma.

Thus (c) is correct option.

95. Match the items of Column A with those in Column B and select the correct option :

	Column I		Column II
(A)	Cactus	(i)	Exudation of sap from injured part
(B)	Banana leaf	(ii)	Special pores at the tip of veins
(C)	Hydathodes	(iii)	Water droplets along the margin of the leaf only in the morning.
(D)	Bleeding	(iv)	Leaf spines

- (a) (A) - (iv), (B) - (iii), (C) - (ii), (D) - (i)
 (b) (A) - (iv), (B) - (ii), (C) - (iii), (D) - (i)
 (c) (A) - (iv), (B) - (iii), (C) - (i), (D) - (ii)
 (d) (A) - (iv), (B) - (i), (C) - (iii), (D) - (ii)

Ans :

MAIN 2010

Cactus have leaf spines which protect the plant from predators, provide shade, help regulate temperature, reduce water loss and even help the plant to spread and reproduce. Droplets of water may sometimes be seen along the margins of the leaves of a banana plant, growing in wet soil only in the mornings. Hydathodes are specialized pores (openings) particularly present at the tip of veins on the leaf margins. The exudation of cell sap from an injured part of a plant is called bleeding. Thus (a) is correct option.

ONE MARK QUESTIONS

DIRECTION : Name the following :

96. The openings on the barks of trees through which transpiration

Ans :

SQP 2025

Potometer

97. Name the structures through which Transpiration and Guttation occur in a plant.

Ans :

SQP 2025

Transpiration — Stomata, Lenticels, Cuticle

Guttation — Hydathodes

138. Folded leaves _____ transpiration.

Ans : MAIN 2008
reduces

139. In Nerium, stomata are _____.

Ans : COMP 2004
sunken

DIRECTION : Mention whether the following statements are True or False. If false, correct and rewrite by changing the first or last word only:

140. Low humidity in the atmosphere results in a decrease in the rate of transpiration.

Ans : SQP 2004, 1996
False.

141. The rate of transpiration will be more if the air is humid.

Ans : MAIN 2002, 1995
False, The rate of transpiration will be more if the air is dry.

142. The pH of the guard cells increases during day time.

Ans : SQP 2013
True.

143. The escape of plant-sap from the cut surface is called guttation.

Ans : COMP 2009
False, The escape of plant-sap from the cut surface is called bleeding.

144. Lower the atmospheric pressure, higher the rate of transpiration.

Ans : MAIN 2010
True,

145. Structure of hydathodes and stomata are similar.

Ans : COMP 2006
False, Structure of hydathodes and stomata are different.

146. Transpiration takes place only in green plants.

Ans : SQP 2010
True.

147. Moist cobalt chloride paper is blue in colour.

Ans : MAIN 2022
False, Dry cobalt chloride paper is blue in colour.

148. Lenticular transpiration occurs in herbs.

Ans : COMP 2019
False, Lenticular transpiration occurs in old stems.

149. The upper surface of the leaves transpires more.

Ans : SQP 2016
False, The upper surface of the leaves transpires less.

150. The wall of guard cells towards the stoma is thin.

Ans : MAIN 2010
False, The wall of guard cells towards the stoma is thick

151. Leaves are reduced to spines in xerophytic plants.

Ans : SQP 2019
True

152. Loss of water in form of droplets is called bleeding.

Ans : MAIN 2013
False, Loss of water in the form of droplets is called guttation.

153. Stomata covered by hairs decreases transpiration.

Ans : SQP 2001
True

154. The upper surface of the leaves transpires more.

Ans : COMP 2007
False

155. Transpiration takes place only in green plants.

Ans : MAIN 2012
True

156. Lenticular transpiration occurs in herbs.

Ans : COMP 2018
False

157. The pH of guard cells increase during day time.

Ans : SQP 2023
True

- 119.** A chemical normally used to test the rate of transpiration on either side of a leaf.

Ans : COMP 2008
Cobalt chloride

- 120.** The structure through which guttation takes place.

Ans : MAIN 2010
Hydathode

- 121.** Small openings present on the bark of woody stems.

Ans : COMP 2022
Lenticels

- 122.** A chemical used to prevent excessive transpiration in plants.

Ans : MAIN 2017
Silicon emulsion/Phenyl Mercuric Acetate (PMA)

- 123.** Three different kinds of structures of a plant from where transpiration occurs.

Ans : COMP 2023
(a) Lenticel
(b) Stomata
(c) Cuticle

- 124.** The metallic cation involved in opening and closing of stomata.

Ans : MAIN 2009
Potassium ion.

- 125.** The structure through which most of the transpiration takes place.

Ans : SQP 2020
Stomata

- 126.** The process by which the aerial parts of a green plant give out water as water vapour.

Ans : MAIN 2013
Transpiration.

DIRECTION : Complete the following statements:

- 127.** Hydathodes and _____.

Ans : SQP 2000
Guttation

- 128.** The phenomenon of loss of water through a cut stem or injured part of plant is called _____.

Ans : MAIN 2015
bleeding

- 129.** 97% of the total transpiration takes place through _____.

Ans : SQP 2023
stomata

- 130.** Exchange of gases in plants takes place through _____.

Ans : COMP 2015
stomata

- 131.** _____ has cooling effects on the leaves.

Ans : MAIN 2012
Transpiration

- 132.** The leaves of the _____ plants have cuticular wax.

Ans : SQP 2005
xerophytic

- 133.** The minute pores on the epidermis of the leaf are known as _____.

Ans : MAIN 2003
stomata

- 134.** _____ is an instrument for measuring the rate of transpiration.

Ans : COMP 2000
Potometer

- 135.** The chemicals used to reduce the rate of transpiration are called _____.

Ans : MAIN 2004
anti-transpirants/silicon emulsions.

- 136.** Guttation occurs through _____.

Ans : COMP 2017
hydathodes

- 137.** More stomata are located on the _____ surface.

Ans : SQP 2013
ventral

- 98.** An apparatus to compare the rate of transpiration in cut shoots.

Ans : SQP 2000
Potometer

- 99.** Respiratory openings found on the stems of woody plants.

Ans : MAIN 2000
Lenticels

- 100.** The process by which intact plants lose water in the form of droplets.

Ans : COMP 2015, 1999
Guttation

- 101.** Openings on the stem through which transpiration occurs.

Ans : MAIN 2005, 1999
Lenticels

- 102.** Openings found on the under surface of dorsiventral leaves.

Ans : SQP 2020
Stomata

- 103.** The paper which is used to show loss of water through stoma of a leaf

Ans : COMP 2017
Cobalt chloride paper

- 104.** An instrument used for measuring the rate of transpiration.

Ans : MAIN 2021
Potometer

- 105.** The loss of water from injured parts of a plant.

Ans : SQP 2017
Bleeding

- 106.** A plant with sunken stomata.

Ans : MAIN 2010
Nerium, Pinus

- 107.** The wax-like layer on the epidermis of leaves which reduces transpiration.

Ans : COMP 2018, 2013
Cuticle

- 108.** The plant having sunken stomata.

Ans : MAIN 2010
Nerium

- 109.** The cells which control opening and closing of stomata.

Ans : SQP 2018
Guard cells

- 110.** The plant in which stomata are absent.

Ans : MAIN 2021
Hydrilla (Submerged aquatic plant)

- 111.** The plant having sunken stomata.

Ans : COMP 2013
Nerium

- 112.** The structure through which guttation takes place.

Ans : SQP 2023
Hydathodes

- 113.** An experiment to demonstrate transpiration.

Ans : MAIN 2014
Bell jar experiment

- 114.** An apparatus used to compare the rate of transpiration in cut shoot.

Ans : COMP 2019
Potometer

- 115.** A chemical normally used to test the rate of transpiration on either side of a leaf.

Ans : MAIN 2003
Cobalt chloride

- 116.** The process of loss of water in the form of droplets.

Ans : COMP 2019
Guttation

- 117.** The small pores present on the leaf.

Ans : SQP 2017
Stomata

- 118.** The experiment to demonstrate transpiration.

Ans : MAIN 2021
Bell jar experiment

158. Loss of water is called bleeding.

Ans :

MAIN 2020

False

DIRECTION : Write the exact location of the following:

159. Hydathodes.

Ans :

COMP 2018, 2011

Hydathodes are located along the leaf margins.

160. Stoma.

Ans :

MAIN 2010

Stoma is located on the epidermis of the leaves.

161. Lenticles.

Ans :

SQP 2016

Lenticles are located on the older stems.

162. Guard cells.

Ans :

COMP 2023

Guard cells are located in stomata.

DIRECTION : State the function of the following:

163. Lenticles

Ans :

MAIN 2014

Lenticle : Exchange of gases in older stems.

164. Sunken stomata

Ans :

SQP 2016

To reduce transpiration.

165. State the exact location of the Guard cells.

Ans :

COMP 2013

Epidermis of leaves

166. Given below are five groups of terms. In each group arrange and rewrite the terms in the correct order as to be in Logical Sequence.

Spongy cells, upper epidermis, stoma, palisade tissue, substomatal space.

Ans :

MAIN 2013

Upper epidermis, palisade tissue spongy cells, substomatal space, stoma.

167. Give biological reasons for the following statement:

In some xerophytes, leaves are modified into spines.

Ans :

SQP 2017

Since xerophytes grow in dry conditions where water is less, in order to reduce transpiration their leaves are modified into spines.

168. State the main function of the Guard cells.

Ans :

COMP 2000

Help in opening and closing of stomata.

169. Stomata

Ans :

MAIN 2022

Stomata : Transpiration and respiration.

170. Hydathodes

Ans :

SQP 2010

Hydathodes : The removal of water drops through hydathodes is called guttation.

171. Guard cells

Ans :

COMP 2017

Guard cells : Help to open and close stomata.

172. Waxy cuticle

Ans :

SQP 2020

Waxy cuticle helps to reduce transpiration rate.

173. Leaf spines

Ans :

MAIN 2016

Leaf spines help to reduce transpiration.

DIRECTION : Give scientific or technical terms for the following :

174. Loss of water in the form of water droplets from the margin of leaves.

Ans :

MAIN 2003, 1997

Guttation

175. Transports manufactured food from leaves to other parts of the plant.

Ans :

SQP 2002

Phloem.

176. The waxy layer on the epidermis of the leaf meant to reduce transpiration.

Ans : COMP 2013

Cuticle

- 177.** An apparatus that measures the rate of water uptake in a cut shoot due to transpiration.

Ans : MAIN 2017

Ganong's potometer

- 178.** Permanently open structures seen on the bark of an old woody stem.

Ans : COMP 2013

Lenticels

- 179.** Exudation of sap from injured parts of a plant.

Ans : SQP 2015

Bleeding

- 180.** A waxy layer covering the epidermis of leaves.

Ans : MAIN 2010

Cuticle

- 181.** The kidney-shaped structures present in the stomata.

Ans : COMP 2021

Guard cells

- 182.** Loss of water from the aerial parts of the plant.

Ans : SQP 2023

Transpiration.

DIRECTION : Account for the following or give scientific reason:

- 183.** In some xerophytes leaves are modified into spines.

Ans : MAIN 2017

Modification of leaves into spines is an adaptive feature of xerophytes. Xerophytes grow in regions where water is scarce. This modification reduces transpiration.

- 184.** The leaves of certain plants roll up on a bright sunny day.

Ans : SQP 2010

On a bright sunny day, the rate of transpiration is more than the rate of absorption of water. Leaves contain numerous stomata through which transpiration occurs. Rolling up of leaves reduces

the exposed surface area for transpiration.

- 185.** Balsam plants wilt during midday even if the soil is well-watered.

Ans : COMP 2014

The rate of transpiration is greater than the rate of absorption during midday. So, Balsam plants wilt during midday.

- 186.** Transpiration cools the plants.

Ans : MAIN 2016

Transpiration reduces temperature of the leaf surface.

- 187.** Herbaceous plants growing in well-watered soil are found to wilt on a hot day.

Ans : COMP 2012

On a hot day, the rate of transpiration is greater than the rate of absorption of water from the soil. Therefore, the cells of herbaceous plants lose turgidity and wilt fast.

- 188.** Xerophytes have their leaves modified to spines or reduced in size.

Ans : SQP 2021

Xerophytes grow in regions where availability of water is scarce. In order to reduce transpiration, their leaves are modified into spines or reduced in size.

- 189.** Rate of transpiration will be more on a windy day rather than on a calm day.

Ans : COMP 2011

On a windy day, the water vapour released during transpiration is removed faster from the leaves. The surrounding area becomes unsaturated which makes water pass out of the plant as water vapour. This enhances the rate of transpiration.

- 190.** In a winter morning, droplets of water may be seen along the margin of grass plants leaves.

Ans : MAIN 2002

During winter, the air around the grass plants become humid, which reduces the rate of transpiration. But, as the rate of absorption is high, this builds up a hydrostatic pressure within the plants and forces the excess water out from the tip of the vein through hydathodes. This process is called guttation.

- 191.** Stomata are located more on the ventral side of a leaf.

Ans :

SQP 2005

The rays of sunlight on dorsal surface of the leaves will cause greater loss of water through the stomatal opening. To reduce transpiration, stomata are located on the ventral surface of a leaf.

DIRECTION : Distinguish between the following pairs :

- 192.** Write down the difference between the following pairs as indicated within the brackets :
Guttation and bleeding in plants (cause)

Ans :

SQP 2011

Guttation : Loss of water in the form of droplets through hydathodes.

Bleeding : Exudation of sap from the injured part.

- 193.** Differentiate between :

- Transpiration and guttation (form of water)
- Lenticels and stomata in old plants (gases given out during day time).

Ans :

COMP 2012

(i)	Transpiration In the form of water vapours	Guttation In the form of water droplets
(ii)	Lenticels Carbon dioxide	Stomata Oxygen

- 194.** Differentiate between Stoma and stroma

Ans :

MAIN 2012

Stoma: The small opening between the guard cells.

Stroma is the ground substance of chloroplast.

- 195.** Stomata and Lenticels.

Ans :

SQP 2007

	Stomata		Lenticels
(a)	Minute openings present mainly on leaves	(a)	These are found in the bark of woody stems.
(b)	Stomata can be opened and closed	(b)	These are always opened.

(c)	Contain guard cells.	(c)	Guard cells are absent
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- 196.** Transpiration and Guttation.

Ans :

MAIN 2013

	Transpiration		Guttation
(a)	Water is lost in the form of water vapour. (gaseous form)	(a)	Water is lost in the form of droplets. (liquid form)
(b)	Occurs during day time.	(b)	Occurs during night.
(c)	Occurs mainly through stomata	(c)	Occurs through hydathodes.

- 197.** Transpiration and Translocation.

Ans :

COMP 2021

	Transpiration		Translocation
(a)	It is the loss of water in the form of vapour.	(a)	It is the transportation of food materials within the plant body.
(b)	It occurs through stomata.	(b)	It occurs through vascular tissues, i.e. xylem and phloem.

- 198.** Stomatal transpiration and Cuticular transpiration.

Ans :

SQP 2020

	Stomatal Transpiration		Cuticular Transpiration
(a)	It occurs through stomata.	(a)	It occurs through cuticle of the leaves.
(b)	Transpiration is more in the leaves.	(b)	Transpiration is less in the leaves due to the presence of cuticle.

- 199.** Lenticular Transpiration and Stomatal Transpiration.

Ans :

COMP 2011

240. Explain forests bring rain.

Ans :

MAIN 2013

Trees absorb water through the roots and the excess water in the form of water vapour is given out by the tree leaves through the process of transpiration. Trees produce 10 times more water vapours than herbaceous plants. The water vapours when it rises up in the atmosphere cools and forms water. These condensed water forms clouds that precipitates to the earth's surface in the form of rain, hail or snow. Therefore, trees or forest brings rain to the surrounding area.

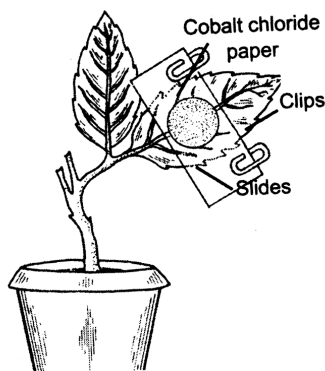
FIVE MARKS QUESTIONS

241. Describe an experiment to prove that transpiration occurs more from the under surface of dorsiventral leaves.

Ans :

COMP 2004, 1997

Aim : To demonstrate that more transpiration occurs from the lower surface of a dorsiventral leaf as compared to upper surface.



Requirements : A well-watered potted plant with broad leaves, dry cobalt chloride strips, leaf clamps.

Procedure : Fix dry cobalt chloride strips on both the surfaces of a leaf of the potted plant with the help of leaf clamps as in Figure.

Observe the changes in the colour of cobalt chloride strips on both the surfaces at the same time.

Observations : Cobalt chloride strip fixed on the lower surface of the leaf turns pink much earlier as compared to the one that is fixed on the upper surface.

Inference Cobalt chloride strip turns pink because of water. Since the strip of cobalt chloride fixed on the lower surface turns pink in lesser time, it proves that the loss of water (transpiration) from the lower surface is more.

242. The figure below represents an experiment performed to demonstrate certain phenomenon in plants. The set-up was kept in sunlight for about two hours:

- What is the aim of the experiment ?
- Define the process mentioned in (i) above.
- What do you observe in the experiment as an evidence of the process stated in (i) and (ii) above ?
- What precautions are taken for proper results in the experiment ?
- Suggest a suitable control experiment for comparison.



Ans :

SQP 2019, 1993

- To demonstrate the phenomenon of Transpiration.
- Transpiration is the loss of water from aerial parts of the plants in the form of water vapours.
- The water droplets can be seen on the inner surface of the polythene bag.
- The apparatus must not be kept in a very hot place as the water vapour will not condense.
 - Polythene bag must be air tight to prevent the entry of water vapour from outside.
- Take a pot without plant covered with polythene bag.

- 208.** Mention three adaptations found in plants to reduce transpiration.

Ans :

SQP 2012

- (a) Presence of sunken stomata.
- (b) Leaf may be modified into spines.
- (c) Presence of thick cuticle on the epidermis.

- 209.** Explain the term Guttation.

Ans :

COMP 2018

The process of removal of water in the form of drops of water through hydathodes. Guttation occurs due to increased hydrostatic pressure that develops within the cells.

- 210.** Define transpiration.

Ans :

COMP 2023

The loss of water in the form of water vapour through the aerial parts of a plant.

- 211.** What are anti-transpirants ?

Ans :

MAIN 2009

Chemicals used to reduce excessive transpiration in the plant leaves.

- 212.** Name three factors which affects transpiration.

Ans :

COMP 2004

- (a) Sunlight, (b) Humidity, (c) Wind.

- 213.** How are guard cells adapted for transpiration ?

Ans :

SQP 2016

The outer wall of guard cell is thin while the inner wall is thick. The guard cells control the opening and closing of stomata by changing their turgidity.

- 214.** Why do plants absorb more water than required ?

Ans :

MAIN 2019

To get sufficient minerals plants have to absorb water.

- 215.** How does sunlight affect transpiration ?

Ans :

SQP 2013

Sunlight affects transpiration in two ways:

- (a) During day time, photosynthesis takes place and guard cells open stomata.
- (b) It increases the temperature of the leaves.

- 216.** What is bleeding?

Ans :

MAIN 2021

Exudation of plant sap through the injured part of a plant is called bleeding.

- 217.** What is cuticle?

Ans :

SQP 2010

It is a non-cellular layer secreted by the epidermal cells.

- 218.** What is lenticel?

Ans :

COMP 2001

The opening present on the bark of woody stem.

TWO MARKS QUESTIONS

- 219.** How does the rate of Transpiration differ when there is :

- (a) High temperature
- (b) High humidity

Ans :

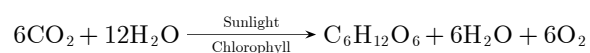
SQP 2025

- (a) Increases
- (b) Decreases

- 220.** Write the overall chemical equation for Photosynthesis.

Ans :

SQP 2025



- 221.** Mention Two advantages of transpiration.

Ans :

MAIN 2024

Advantages of transpiration :

- (i) Transpiration helps to cool plants and regulate their temperature. As water evaporates from the leaves, it takes up heat energy, thus lowering the temperature of the plant.
- (ii) Transpiration creates a suction force that helps to draw water and nutrients from the soil into the plant roots. This process is essential for the growth and development of plants.

- 222.** Mention the limitations of potometer.

Ans :

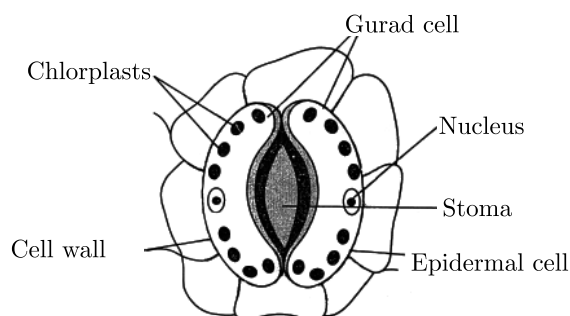
MAIN 2022

- (a) Introducing the air bubble is not very easy.
- (b) Any change in the outside air temperature may affect the position of air bubble in the capillary tube.

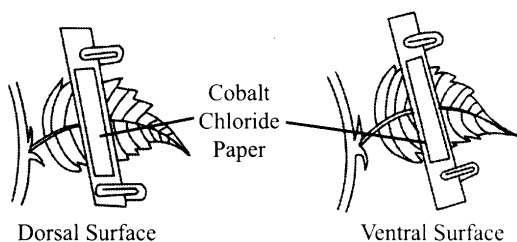
Ans :

SQP 2019

- (i) Transpiration, It is the loss of water in the form of water vapour from aerial exposed parts of plants.
- (ii) To prevent escape of water vapour from the pot.
- (iii) - Intensity of sunlight
- Increase in temperature
- (iv) - Sunken stomata
- Thick cuticle
- (v)



- 250.** Given is an experimental set up to demonstrate a particular process. Study the same and answer the question that follow:



- (i) Name the physiological process being studied.
- (ii) What is the aim of the above experiment?
- (iii) What would you observe in the experimental set-up after an hour?
Give a reason to support your answer.
- (iv) Mention any three adaptations found in plants to overcome the physiological process mentioned in (i) above.

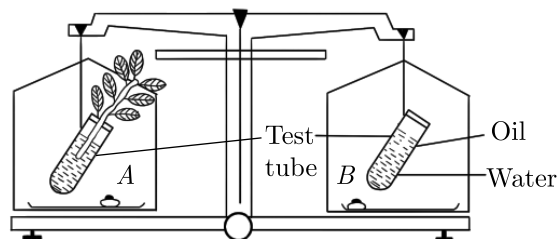
Ans :

COMP 2012

- (i) Transpiration
- (ii) To show that the rate of transpiration is more on the ventral surface of the leaf than the dorsal surface.
- (iii) The cobalt chloride paper on the ventral surface turns pink faster than the dorsal side as more stomata are present on the ventral surface. Hence, more transpiration.

- (iv) (1) Sunken stomata
(2) Thick cuticle
(3) Narrow leaves
(4) Modification of leaves into spines.

- 251.** The figure given below represents an experimental set up with a weighing machine to demonstrate a particular process in plants. The experimental set up was placed in bright sunlight. Study the diagram and answer the following questions:



- (i) Name the process intended for study.
- (ii) When the weight of the test tube (A and B) is taken before and after the experiment, what is observed ? Give reasons to justify your observation in A and B.
- (iii) What is the purpose of keeping the test tube B in the experimental set up ?

Ans :

SQP 2014

- (i) Transpiration.
- (ii) It is observed in test tube A that after the experiment, the weight has decreased, and in test tube B, the weight remains same. In test tube A, transpiration took place and weight decreased. In test tube B is used as a control, no plant is kept, oil is added and so, no transpiration has taken place.
- (iii) Test tube B is a control.

- 252.** Explain briefly :

- (i) Xerophytes have their leaves modified to spines or reduced in size.
- (ii) A higher rate of transpiration is recorded on a windy day rather than on a calm day.
- (iii) During the day transpiration and photosynthesis are interlinked.
- (iv) How the rate of transpiration is affected on :
1. a windy day
2. a foggy day.
- (v) The leaves of certain plants roll up on a bright sunny day.

Ans :

MAIN 2010, 2006, 1999, 1995

- (i) To reduce water loss in order to conserve it.
- (ii) Wind is the external factor which helps in to

- (iii) Loss of water as droplets from hydathodes is called : (Transpiration, Bleeding, Guttation)

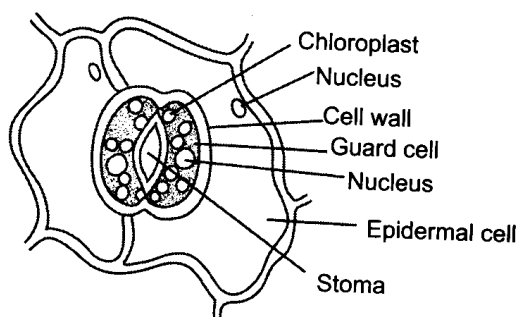
Ans : MAIN 2010

- (i) Open stomata, dry atmosphere and moist soil.
(ii) Guttation
(iii) Guttation

- 231.** Draw a neat diagram of the stomatal apparatus found in the epidermis of leaves and label the stoma, guard cells, chloroplast, epidermal cells, cell wall and nucleus.

Ans : COMP 2017

A Stomatal apparatus.



- 232.** Mention three adaptations found in plants to reduce transpiration.

Ans : MAIN 2009

- (i) Thick cuticle
(ii) Narrow leaves
(iii) Sunken stomata

- 233.** Blowing wind can be useful to the plants in many ways. Mention any three such uses giving a suitable example wherever possible.

Ans : SQP 2006

Blowing wind helps in :

- (i) the dispersal of fruits and seeds of the plants. e.g. Oak.
(ii) cross pollination, e.g. maize.
(iii) increasing transpiration and so absorption of water and mineral.

- 234.** What are the anatomical adaptations observed in plants which checks transpiration.

Ans : MAIN 2015

1. Stomata in sunken pits
2. Waxy cuticle
3. Multiple (thick) epidermis

4. Presence of dense cutinised hairs and scales around stomata.

- 235.** Name the factors which control transpiration.

Ans : SQP 2003

1. Sunlight
2. Temperature
3. Humidity of air
4. Wind velocity
5. Available soil water

- 236.** Mention three advantages of transpiration.

Ans : COMP 2018

- (i) It provides a suction force.
(ii) It produces a cooling effect.
(iii) It helps in the distribution of water throughout the plant.

- 237.** Explain the mechanism of stomatal transpiration.

Ans : COMP 2012

From the xylem vessels of the leaf veins, water vapour diffuse out into the intercellular spaces of the leaves. When the guard cells draw water from surrounding cells and becomes turgid, the inner thick walls are pulled apart resulting in the opening of the guard cells. Due to this, the gap called the stoma opens and water vapour goes out and thus transpiration takes place.

- 238.** What is Ganong's Potometer used for? Write any two limitations of this apparatus.

Ans : SQP 2003

Ganong's Potometer is used to measure the rate of transpiration.

Limitations are: The introduction of air bubble is not easy, the plant uses some water for photosynthesis, and other metabolic activities which cannot be measured.

- 239.** How does velocity of wind affect the rate of transpiration?

Ans : SQP 2023

If the velocity of wind increase, the rate of transpiration increases. High velocity of wind removes water vapour from near the surface of leaves and the surrounding area is not saturated as a result transpiration rate is higher. If wind velocity is low, the water vapours are not removed from near the leaf surface and so transpiration is slow.

223. Explain how the rate of transpiration is affected on:

- (a) a windy day
- (b) a foggy day

Ans :

MAIN 2020

- (a) On a windy day, the water vapour released from the leaves by transpiration is removed at a faster rate near the ventral leaf surface. The surrounding air around the leaf does not get saturated with water. So, transpiration is more during windy day.
- (b) On a foggy day, the area surrounding the plant leaves are saturated with water. So, water vapour from the leaves is removed very slowly thereby reducing the rate of transpiration.

224. A well watered potted plant shows wilting of leaves on hot sunny day. Explain the reason.

Ans :

COMP 2011

On a hot sunny day, there occurs greater transpiration than the water absorbed by the roots hence it results in wilting of leaves.

225. Briefly explain how the rate of transpiration is affected by

- (i) Intensity of light
- (ii) Humidity of the atmosphere

Ans :

SQP 2001

- (i) More the intensity of light, more is the rate of transpiration.
- (ii) Humidity decreases rate of transpiration.

226. Why do plants absorb more water than what is required by them ?

Ans :

SQP 2017

Plants absorb more water than what is required by them because minerals are present in extremely small quantity in absorbed water. Hence, to obtain a continuous supply of minerals, they have to absorb large quantities of water.

227. What is wilting ? What are the causes of this condition?

Ans :

MAIN 2002

The drooping down of leaves due to loss of water is called wilting. It may be caused due to excessive transpiration, blocking of xylem elements.

228. Define wilting.

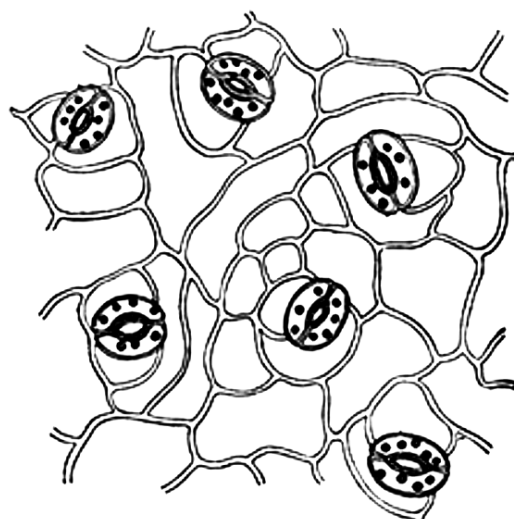
Ans :

MAIN 2018

If the rate of transpiration exceeds the rate absorption of water by the roots, leave cells of herbaceous plants lose turgidity and the leaves droop. This condition is called wilting.

THREE MARKS QUESTIONS

229. Sam observed a slide containing the lower epidermis of a leaf under a microscope. A number of tiny openings between the epidermal cells were present as shown below in the diagram:



- (i) What are these tiny openings called?
- (ii) Name the cells that regulate the opening and closing of the: structures.
- (iii) Which ion is responsible for the opening and closing of the: openings?

Ans :

SQP 2025

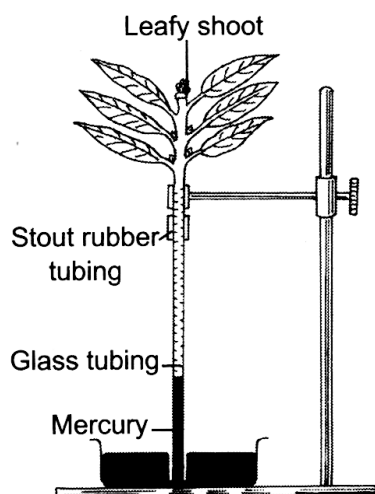
- (i) Stomata
- (ii) Guard cells
- (iii) K^+ / Potassium ions

230. Choose the correct alternative :

- (i) Transpiration pull will be maximum under which of the following conditions : (open stomata, dry atmosphere and moist soil; open stomata, high humid atmosphere and well irrigated soil; open stomata, high humid atmosphere and dry soil; closed stomata, dry atmosphere and dry soil).
- (ii) Loss of water as droplets through leaves of an intact plant is termed (bleeding, guttation, transpiration).

243. The given diagram represents an experiment to demonstrate a certain phenomenon in a green plant.

- Has the level of mercury in the glass tubing risen or fallen ?
- Name the life process of the plant which has caused the change in the level of mercury.
- Define the process named above.
- State any three advantages of this process to the plant.
- Which conducting tissue of the plant does the glass-tubing represent-xylem or phloem ?

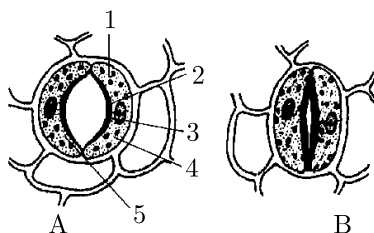


Ans :

MAIN 2008, 1995

- The level of mercury in the glass tubing has risen.
- Transpiration.
- Loss of water in the form of vapours from the aerial parts of a plant is called transpiration.
- It helps in absorption of water by roots.
 - It helps in absorption of minerals from soil water.
 - It helps in movement of water in the plants.
- Xylem.

244. Given below are the diagrams of a certain structure in plants in two conditions.



- Name the structure shown.

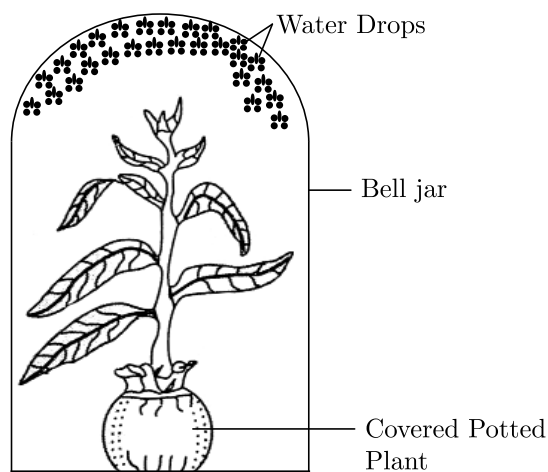
- Name the parts numbered 1-5.
- What is the most apparent difference between A and B in the structure shown ?
- Describe the mechanism which brings about the change in the structure depicted in A and B.

Ans :

COMP 2017, 1999

- The structure shown are the stomata present in the epidermal layer of the leaf.
- Guard cell,
 - Thickening of the inner walls of the guard cell,
 - Nucleus of the guard cell,
 - Outer thin cell-wall,
 - Stomata.
- In A, the stomata is open while in B, the stomata is closed.
- The opening and closing of the stomata are due to the change in turgidity of the guard cells and this change is mainly connected with two factors – Light and Water. In the presence of light, the guard cells photosynthesise, sugar produced increase osmotic pressure and they absorb water from the neighbouring cells by endosmosis expand and bulge out in an outward direction; and the stomata opens as in A. In the absence of light, the guard cells lose water and become flaccid, and the stomata closes. The intensity of light also directly affects the degree of stomatal opening.

245. An apparatus as shown below was set-up to investigate a physiological process in plants. The set-up was kept in sunlight for two hours. Droplets of water were then seen inside the bell jar. Answer the questions that follow :



	Lenticular Transpiration		Stomatal Transpiration
(a)	It takes place through lenticels.	(a)	It takes place through stomata.
(b)	Does not contain guard cells to control it.	(b)	Contains guard cells to control it.

200. Mention one condition in which the stomatal opening Mention any two differences between :

- (a) Transpiration and Evaporation
(b) Stomata and lenticels.

Ans :

SQP 2001

(a)

	Transpiration		Evaporation
1.	It is a physiological process.	1.	It is purely a physical process.
2.	It usually occurs at day time.	2.	It occurs all time.

(b)

	Stomata		Lenticels
1.	Located on lower surface of dicot leaves, both surfaces of monocot leaves.	1.	Located on stem and branches of woody plants.
2.	Remain open during daytime.	2.	Remain open every time.

201. Transpiration and Perspiration.

Ans :

SQP 2003

	Transpiration		Perspiration
(a)	It takes place in plants.	(a)	It takes place in animals.
(b)	It takes place mainly through stomata.	(b)	It takes place through sweat pores in the skin.

202. Match the items given in column I with those of column II :

	Column I		Column II
1.	Transpiration	(a)	Cactus
2.	Movement of water	(b)	Stomata

3.	Guttation	(c)	Maize plant
4.	Low rate of transpiration	(d)	Xylem
5.	High rate of transpiration	(e)	Hydathodes

Ans :

MAIN 2014

1 – (b), 2 – (d), 3 – (e), 4 – (a), 5 – (c).

DIRECTION : Rewrite the terms in logical sequence as directed at the end of each statement.

203. Stoma, Mesophyll cells, Xylem, Substomatal space, Intercellular space. (loss of water due to transpiration)

Ans :

SQP 2010

Xylem, Mesophyll cell, Intercellular space, Substomatal space, Stoma.

204. Endodermis, Cortex, Soil water, Xylem, Root hair.

Ans :

COMP 2013

Soil water, root hair, cortex, endodermis, xylem

DIRECTION : Answer the following :

205. How does Transpiration help in the uptake of water from the soil?

Ans :

SQP 2025

As water evaporates, a suction force is created which draws water up through the stem.

206. Explain the following terms :

- (i) Bleeding
(ii) Transpiration

Ans :

SQP 2006, 2001

- (i) Bleeding – Exudation of sap or watery solution from the cut or injured parts of a plant is called bleeding.
(ii) Transpiration is the loss of water in the form of water vapours from the aerial parts of plants.

207. List any two advantages of transpiration to a plant.

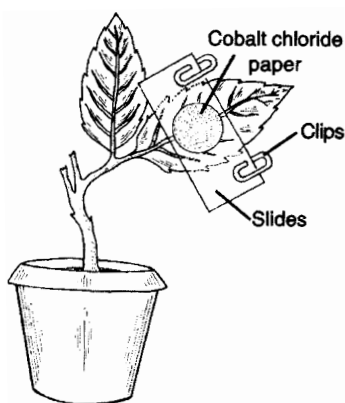
Ans :

MAIN 2001

Ascent of sap, Cooling.

- (ii) The plant will loose weight as in bright sunlight, the rate of transpiration will be maximum.
- (iii) 1. Remains same
2. Decreases
- (iv) Thick cuticle/loss of leaves/narrow leaves/
fewer stomata/sunken stomata
- (v) Loss of water in the form of liquid as droplets
from the margins of leaves is called guttation.

248. Given below is the diagram of an experimental setup to study the process of Transpiration. Cobalt chloride papers are fixed on the upper as well as lower surface of the leaf.



Answer the questions that follow :

- (i) What is the aim of the experiment ?
 - (a) To prove that more transpiration occurs from the lower surface of a dicot leaf
 - (b) To prove that more transpiration occurs from the copper surface of a dicot leaf.
 - (c) To prove that transpiration is equal on both sides of the leaf
 - (d) To prove that transpiration does not take place in a dicot leaf
- (ii) What is the colour of dry cobalt chloride paper ?
 - (a) Pink
 - (b) Blue
 - (c) Brown
 - (d) White
- (iii) After about an hour, what change if any, would you expect to find in the cobalt chloride paper placed on the upper and lower surface of the leaf?
 - (a) Upper surface – Pink, Lower Surface – Blue.
 - (b) Upper surface – White, Lower surface – Blue.
 - (c) Upper surface – less pink, Lower surface – more pink.

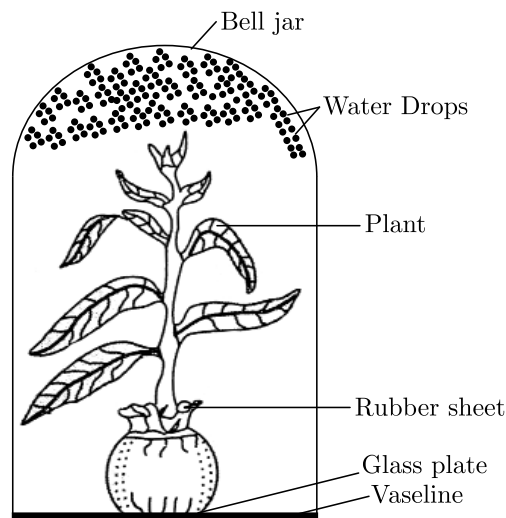
- (d) Upper surface – more pink, Lower surface – less pink.
- (iv) Two adaptations in plants to reduce Transpiration are :
 - (a) Narrow leaves, Thin cuticle,
 - (b) Fewer stomata, Broad lamina of leaves.
 - (c) Thin cuticle, Sunken stomata.
 - (d) Narrow leaves, Fewer stomata.
- (v) The rate of transpiration is less when there is:
 - (a) High humidity in the air and low temperature.
 - (b) Less humidity in the air and decrease in atmospheric pressure.
 - (c) Bright sunlight and high temperature.
 - (d) More wind and low intensity of sunlight.

Ans :

COMP 2021

- (i) (a) To prove that more transpiration occurs from the lower surface of a dicot leaf
- (ii) (b) Blue
- (iii) (c) Upper surface – less pink, lower surface – more pink.
- (iv) (d) Narrow leaves, Fewer stomata
- (v) (a) High humidity in the air and low temperature.

249.



- (i) Name the process being studied. Define the process.
- (ii) Why was the pot enclosed in a rubber sheet ?
- (iii) Mention two external factors which can accelerate the above process.
- (iv) List two adaptations in plants to reduce the above process.
- (v) Draw a neat, labelled diagram of a stomatal apparatus.

NODIA

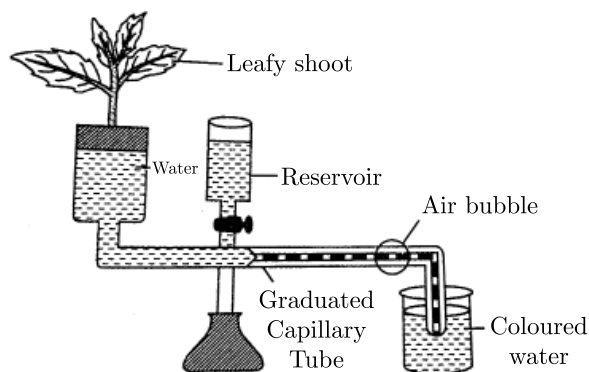
- Name the process being studied.
- Explain the process named above in (i).
- Why was the pot covered with a plastic sheet?
- Suggest a suitable control for this experiment.
- Mention two ways in which this process is beneficial to plants.
- List three adaptations in plants to reduce the above mentioned process.

Ans :

MAIN 2015

- The process is Transpiration.
- Transpiration is the loss of water in the form of vapours from the aerial parts of the plant.
- The pot is covered with plastic sheet in order to avoid evaporation of water from the pot.
- The control of this experiment is that the plant must be removed from the set-up.
- Ascent of sap/absorption of water/transport of minerals/cooling effect
- Thick cuticle/loss of leaves/narrow leaves/fewer stomata/sunken stomata.

246. The diagram of an apparatus given below demonstrates a particular process in plants. Study the same and answer the questions that follow :



- Name the apparatus.
- Which phenomenon is demonstrated by this apparatus ?
- Explain the phenomenon mentioned in (ii) above.
- State two limitations of using this apparatus.
- What is the importance of the air bubble in the experiment ?
- Name the structures in a plant through which the above process takes place.

Ans :

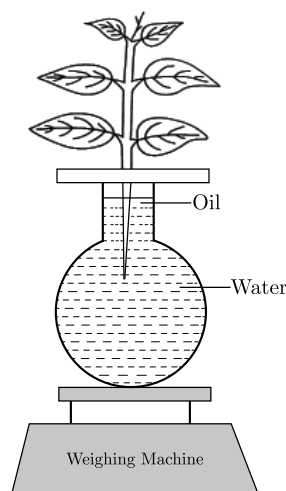
SQP 2016

- Ganong's potometer.
- Rate of transpiration.
- The loss of water in the form of vapours from

the aerial exposed parts of a plant is called transpiration.

- The first limitation of this apparatus is that it is very difficult to introduce the air bubble at the lower end of the capillary tube. Secondly, various changes in the environment such as, temperature, humidity, air velocity etc. may influence the position of air bubble.
- Rate of water uptake can be calculated by timing the air bubble movement over a fixed distance on the scale.
- Transpiration takes place through stomata, cuticle and lenticels.

247. The diagram below represents a process in plants. The setup was placed in bright sunlight. Answer the following questions :



- Name the physiological process depicted in the diagram.
Why was oil added to the water?
- When placed in bright sunlight for four hours, what do you observe with regard to the initial and final weight of the plant?
Give a suitable reason for your answer.
- What happens to the level of water when this setup is placed in:
 - Humid conditions?
 - Windy conditions?
- Mention any three adaptations found in plants to overcome the process mentioned in (i).
- Explain the term 'Guttation'.

Ans :

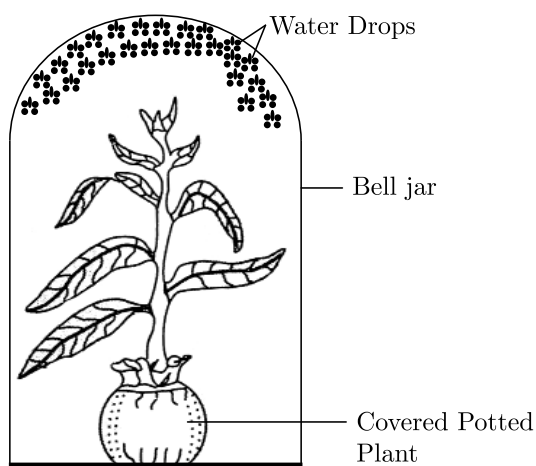
COMP 2018

- Transpiration.
Oil was added in order to prevent evaporation from the round bottom flask.

increase the rate of transpiration.

- (iii) During day the stomata are open to facilitate the inward diffusion of carbon dioxide for photosynthesis and water vapours are also lost to the outside during transpiration.
- (iv) 1. The rate of transpiration on a windy day will increase because the water vapour will not be allowed to accumulate near the leaves.
2. The rate of transpiration on a foggy day will decrease because of the rise of the rate of water vapour in the atmosphere.
- (v) The leaves of certain plants roll up on a bright sunny day, to reduce the exposed surface to reduce transpiration.

253. An apparatus as shown below was set-up to investigate a physiological process in plants. The set-up was kept in sunlight for two hours. Droplets of water were then seen inside the bell jar.



- (i) Name the process being studied.
- (ii) Why was the pot covered with a plastic sheet?
- (iii) Suggest a suitable control for this experiment.
- (iv) Mention two ways in which this process is beneficial to plants.
- (v) List three adaptations in plants to reduce the above mentioned process.

Ans :

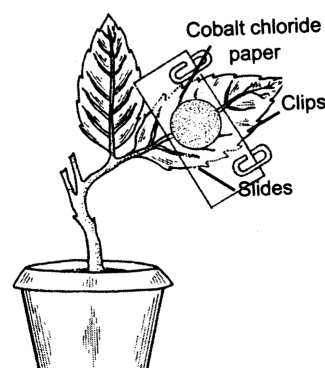
MAIN 2015

- (i) Transpiration.
- (ii) It is covered with plastic sheet to prevent the evaporation of water.
- (iii) Take an empty polythene bag with its mouth tied and keep it in sunlight.
- (iv) The two ways in which it is beneficial for the plants:
1. Cooling effect.
 2. It creates a suction force to absorb more

water.

- (v) The adaptations in plants are:
1. Sunken stomata.
 2. Less number of stomata.
 3. Modification of leaves to spines.
 4. Narrow leaves/curled leaves

254. Given below is the diagram of an experimental set up to study the process of transpiration in plants. Study the same and then answer the questions that follow :



- (i) What is the colour of dry cobalt chloride paper ?
- (ii) Is the experimental leaf a monocot or a dicot? Give a reason to support your answer.
- (iii) Why are glass slides placed over the dry cobalt chloride papers ?
- (iv) After about half an hour, what change, if any, would you expect to find in the cobalt chloride paper placed on the dorsal and ventral sides of the leaf ? Give a reason to support your answer.
- (v) Define the term 'transpiration'.

Ans :

SQP 2006, 1992

- (i) Blue.
- (ii) Dicot leaf. Because the leaf has reticulate venation.
- (iii) To keep the strips of cobalt chloride paper at their places.
- (iv) The dorsal cobalt chloride paper will turn pink less; while on ventral side it will turn pink more.
- (v) It is a process in which the water is lost in the form of vapours from the aerial parts of the plant.

255. Describe any Three conditions which affect transpiration.

Ans :

SQP 2007, 1994

4. NADP is expanded as :

- (a) Nicotinamide Adenosine Dinucleotide Phosphate.
- (b) Nicotinamide Adenine Dinucleotide Phosphate.
- (c) Nicotinamide Adenine Dinucleolus Phosphate.
- (d) Nicotinamide Adenosine Dinucleolus Phosphate.

Ans :

COMP 2021

The full form of NADP is nicotinamide adenine dinucleotide phosphate which will become NADPH (nicotinamide adenine dinucleotide phosphate + hydrogen) after reduction.

Thus (b) is correct option.

5. Photosynthesis :

- (a) It is the synthesis of glucose from carbon dioxide by non-green plants using light energy.
- (b) It is the synthesis of glucose by green plants from carbon dioxide using light energy.
- (c) It is the synthesis of glucose from carbon dioxide and water by non-green plants using light energy.
- (d) It is the synthesis of glucose from carbon dioxide and water by non-green plants using light energy.

Ans :

MAIN 2021

Thus (d) is correct option.

6. A plant biologist is examining the structure of chloroplasts, specifically the role of the grana in photosynthesis. She wants to determine which processes do not take place in the grana. Grana of chloroplast is not the :

- (a) Site of Light Independent Phase.
- (b) Site of Light Dependent Phase.
- (c) Site of Photolysis.
- (d) Site of Photon absorption.

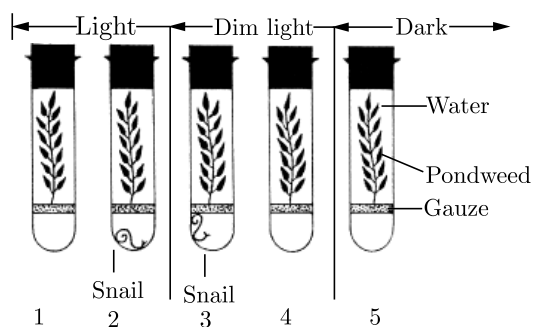
Ans :

SQP 2021

In C_4 plants, agranal chloroplast is present in bundle sheath cells. E.g sugarcane leaf.

Thus (a) is correct option.

7. The following diagram is a setup to demonstrate an experiment.



Pond weed was placed in five water-filled tubes. The experiment was set-up shown in the diagram. The tubes were then left for 24 hours. Write the correct answer out of the five available choices given under each question.

(i) In which tube would you expect the greatest increase in dry weight of the pond weed ?

- (a) 1
- (b) 2
- (c) 3
- (d) 4
- (e) 5

Ans :

COMP 2021

Because the snail provides carbon dioxide through its respiration and thus, more photosynthetic activity takes place.

Thus (b) is correct option.

(ii) In which tube would you expect to find the plant with the least amount of starch ?

- (a) 1
- (b) 2
- (c) 3
- (d) 4
- (e) 5

Ans :

COMP 2021

Because the plant is in dark. So there will be no photosynthesis.

Thus (e) is correct option.

(iii) The tube in which most oxygen would be found is:

- (a) 1
- (b) 2
- (c) 3
- (d) 4
- (e) 5

Ans :

COMP 2021

Because it is in full light and no animal is present to utilize the oxygen released by the plant.

Thus (a) is correct option.

(iv) The tube in which least carbon dioxide would be found is :

- (a) 1
- (b) 2
- (c) 3
- (d) 4
- (e) 5

Ans :

COMP 2021

Because no snail to release carbon dioxide and the plant is utilizing the existing gas.

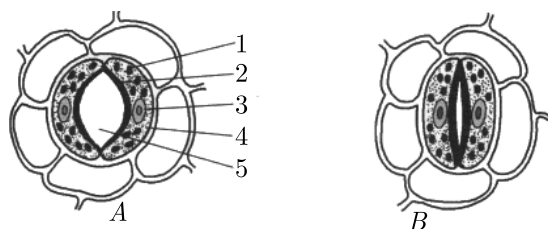
Thus (a) is correct option.

(v) The tube in which the plant would survive for the shortest length of time is :

- (a) 1
- (b) 2
- (c) 3
- (d) 4
- (e) 5

Ans :

COMP 2021



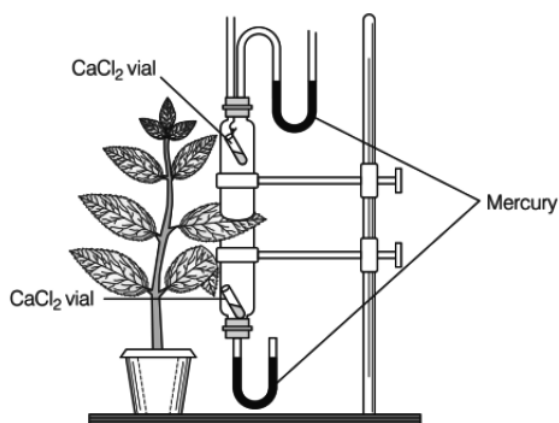
- Name the structure shown.
- Name the parts numbered 1-5.
- What is the most apparent difference between A and B in the structure shown?
- Describe the mechanism which brings about the change in the structure depicted in A and B.

Ans :

SQP 2019

- Stomata
1. Chloroplast; 2. Inner wall of guard cell; 3. Nucleus; 4. Outer wall of guard cell; 5. Stoma.
- In A, the stoma is open. In B, it is closed.
- The guard cells have thick inner wall and a thin outer wall. Guard cells contain chloroplast which synthesises glucose and increases osmotic pressure and draws water inside and cells become turgid and bulge outward and widening the stomatal opening. During night, reverse process occurs and cells become flaccid and close.

- 261.** The apparatus shown is Garreau's potometer designed to demonstrate unequal transpiration from the two surfaces of a dorsiventral leaf. Before keeping the leaf in between the cups, anhydrous calcium chloride (CaCl_2) contained in two small vials were weighed and placed in both the cups. The ends of the cups were closed with corks through which two mercury manometers were connected.



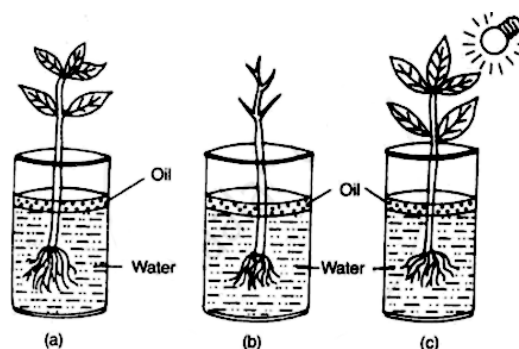
- What is the purpose of keeping CaCl_2 vials inside the cup?
- After a few hours, CaCl_2 vials were taken out and weighed again. Will you expect any difference in weight? If so, give reasons.
- What was the purpose of using a manometer?
- What do you mean by transpiration?

Ans :

COMP 2004

- To absorb the moisture formed by transpiration.
- Yes, the weight of CaCl_2 vial kept on the lower side will be more as moisture has been absorbed because transpiration is more on the lower surface of the leaves.
- To check the outside and inside pressures.
- The loss of water in the form of water vapour from the aerial parts of a plant.

- 262.** A botanist is conducting an experiment using three plants (A, B, and C) placed in beakers of water. The water in each beaker is covered with a layer of oil to prevent evaporation. Plant B has its leaves removed, and plant C is exposed to strong light.



- In which plant A, B or C would the water move up fastest?
- In which plant would water move slowly?
- Why is the water covered with oil?
- What is being investigated by this experiment?

Ans :

MAIN 2013

- In plant C, water would move up fastest as the rate of transpiration is high due to the heat emitted by the strong light (bulb).
- In plant B, water would move slowly as there are no leaves.
- The water is covered with oil to check the loss of water by evaporation from the surface.
- It is being investigated whether the intensity of light has a direct effect on the rate of transpiration.

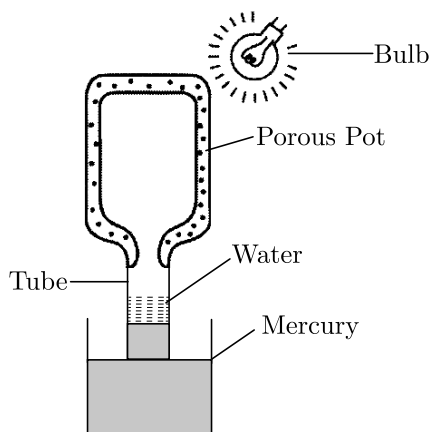
Ans :

SQP 2009

- (i) The apparatus is called as Potometer.
- (ii) (a) In dark, speed of movement of air bubble slows down.
- (b) In bright sunlight, speed of movement of air bubble increases.
- (c) In front of a blower, the speed of movement of air bubble increases.
- (iii) The rate of transpiration increases in sunlight. The rate of transpiration increases with moving air.

263. The experiment set up shown in the diagram represents a particular phenomenon in plants.

- (i) What happens to the level of mercury in the tube.
- (ii) Account for your answer in part (i).
- (iii) What is likely to happen if the bulb is switched



- (iv) Name the structures in plants which are equivalent to the following parts in the diagram :
- (a) Porous pot, (b) Pores in pot, (c) Tube.

Ans :

MAIN 2018

- (i) The level of mercury rises.
- (ii) When the bulb glows evaporation of water takes place from the porous pot. This creates a suction force due to which the level of water, hence mercury increases in the tube.
- (iii) When the bulb is switched off the rate at which mercury is rising in the tube slows down.
- (iv) (a) Leaves (leaf),
- (b) Stomata,
- (c) Xylem.

CHAPTER 5

PHOTOSYNTHESIS

SUMMARY

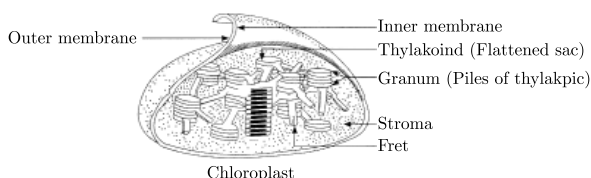
1. PHOTOSYNTHESIS

It is a light energy trapping process in which energy of sunlight is transduced to chemical energy that is the ultimate source of food for almost all living organisms. The energy rich compounds like carbohydrates are formed from water and carbon dioxide using light energy absorbed by chlorophyll from the sunlight.

Photosynthesis means to put together by light, is the only process on earth by which solar energy is converted into chemical energy by autotrophic organisms. Upto 90% of total photosynthesis takes place in the oceans.

1.1 Chloroplast the Site of Photosynthesis

The entire photosynthetic machinery lies in chloroplasts, the green coloured plastids found in green coloured parts of plants, which were discovered by Robert Hill. A chloroplast is enclosed by a double membrane of lipoprotein. The space enclosed by the double membraned envelope is the stroma, the site of dark reaction of photosynthesis. The inner membrane of chloroplast extends at several points across it to form a lamellar system. These lamellae are stacked on top of each other to form grana, the centre of light reaction of photosynthesis.



Each granum is composed of 5-25 discs and each disc said to be thylakoid encloses a space. On the inner surface of the lamellar membrane small spherical structures, called quantasomes are present, which are the structural and functional units of chloroplast. Each quantasome is capable

of absorbing a mole quantum of light.

There are about 40 to 50 chloroplasts present in each leaf cell.

1.2 Pigments Involved in Photosynthesis

Pigments are substances which absorb certain wavelength of visible light. Different colours of pigments are due to the visible spectrum which they reflect or transmit. Chlorophylls and carotenoids are two major groups of pigments found in higher plants. Chlorophylls (the green pigment of plants) are most important pigments active in photosynthetic process. Carotenoids are large group of hydrocarbon pigments found throughout the plant. Carotenes (red coloured) and xanthophylls (yellow coloured) are two important groups of carotenoids. They are usually masked by green chlorophylls but can be seen in leaves prior to leaf fall since chlorophylls break down first. Carotenoids protect photo-oxidation of chlorophyll and absorb and transfer light energy to chlorophyll molecules.

1.3 Requirements of Photosynthesis

Light, chlorophyll, carbon dioxide and water are essential requirements for photosynthesis. Light is needed for some but not all reactions of photosynthesis. There is a light dependent stage of photosynthesis and also a light independent stage in which reactions occur in the absence of light.

For most plants the source of light energy for the reactions of the light dependent stage is the sun. A source of carbon is needed for the synthesis of sugars. Carbon dioxide from the air or in solution or as hydrogen carbonate ions (HCO_3^-) in water, is the only carbon source which plants can use in photosynthesis. Carbon dioxide alone is not sufficient to produce carbohydrates. Hydrogen ions are needed too and water is the only source of hydrogen ions that plants can make use of. The final requirement for photosynthesis is a means of capturing the energy from the sun.

The conditions which affect transpiration are as follows :

- (i) Light : It may be considered one of the most important environmental factors because of its role in causing stomata to open. Besides, the light increases the temperature of the leaf which in turn brings about an increase in transpiration.
- (ii) Temperature : An increase in temperature brings about a decrease in the relative humidity of the air and this in turn increases the rate of transpiration.
- (iii) Humidity of the Atmosphere : The rate of transpiration is directly related to the vapour pressure of the atmosphere. The rate of transpiration decreases with the rise in vapour pressure in the atmospheric air and it increases with the fall in vapour pressure.

CASE BASED QUESTION

256. A gardener notices that his plants wilt during hot, dry afternoons, even with regular watering. He observes water being absorbed by the roots and transported upward, but it is quickly lost. The gardener wants to understand why the plants are losing so much water.

1. Explain the role of transpiration in water movement through the plant.
2. How do environmental conditions like heat and dryness affect transpiration?
3. What is the importance of root water absorption in preventing wilting?
4. Suggest ways to reduce water loss from plants in hot weather.

Ans :

1. Ascent
2. Increase
3. Turgidity
4. Mulching

257. A botany student is studying how plants lose water. She observes that plants lose water through the cuticle, lenticels, and stomata under different environmental conditions.

1. Differentiate between cuticular, lenticular, and stomatal transpiration.
2. How do environmental factors influence each type of transpiration?

3. Why is stomatal transpiration more common in most plants?
4. Explain the role of lenticels in transpiration for woody plants.

Ans :

1. Stomatal
2. Environment
3. Efficiency
4. Openings

258. A researcher finds that guard cells control stomatal opening by swelling with water in the presence of light. Potassium ions play an essential role in this regulation, and the stomata close when it's dark.

1. Describe the role of guard cells in stomatal regulation.
2. How does light affect the opening and closing of stomata?
3. Explain the role of potassium ions in stomatal movement.
4. What changes occur in guard cells during darkness?

Ans :

1. Control
2. Open
3. Turgidity
4. Close

259. A plant physiologist is experimenting to understand how factors like light, temperature, humidity, and wind speed affect water loss through transpiration in plants.

1. How does light intensity influence the rate of transpiration?
2. Explain the effect of temperature on transpiration rates.
3. Why does low humidity increase transpiration in plants?
4. How does wind speed contribute to water loss in plants?

Ans :

1. Increase
2. Increase
3. Gradient
4. Velocity

260. A researcher is studying how environmental factors affect the opening and closing of certain plant structures under varying conditions. He uses diagrams that show the structure in two different states (A and B)

quite often it is stored as sucrose as in sugar cane. In fact, many of our vegetables are really plant food storage organs. For example, potato tubers are storage stems, carrot, turnip and beet roots are storage roots. In many cases, carbohydrates are converted to oils for storage example mustard oil and groundnut oil.

3. **Growth :** Sugar is also transported to actively growing parts of the plant where these provide energy and are used in the formation of cellulose, fats and proteins.

3.5 Importance of Photosynthesis

It is a process upon which all life on Earth depends directly or indirectly. Both carbon dioxide and energy are made available to all living organisms by this process. Oxygen is also produced in the atmosphere which is vital for all aerobic organisms. It is the only process on Earth by which solar energy is trapped by autotrophic organisms and is converted into food for the rest of the organisms.

Only 0.2.% of the light energy falling on Earth is utilized by photosynthetic organisms. Even this much amount of trapped energy is sufficient to meet the food requirements of all other heterotrophs. Not only this, people obtain fodder, firewood, timber and fibres from the plants. Fossil fuels like coal, petroleum and natural gas also are the products of photosynthetic organisms which lived millions of years ago.

3.6 Experiments on Photosynthesis

Simple experiments can be performed to prove the importance of various conditions and requirements for photosynthesis. In all such experiments the basic principle is to use a green potted plant whose leaves has been made starch free (destarched).

Destarching a plant ensures that any starch present after the experiment has been formed under experimental conditions. Hence it is necessary to destarch a plant before the experiment on photosynthesis.

Hydrilla, Vallisneria and Elodia are water plants and can be used to demonstrate an experiment to prove that oxygen is evolved during photosynthesis.

Methylated spirit and alcohol dissolves chlorophyll. Iodine solution turns blue black in the presence of starch.

Ganongs light screen is used in the experiment to demonstrate that light is necessary

for photosynthesis. Variegated leaves are those leaves which have green and yellow patches and chlorophyll is present in the green patches only. Examples of plants with variegated leaves are – Croton, Coleus, Geranium and Tradescantia.

MULTIPLE CHOICE QUESTION

1. The process of conversion of ADP to ATP during photosynthesis is called:
 (a) Photolysis
 (b) Phagocytosis
 (c) Photophosphorylation
 (d) Polymerisation

Ans :

MAIN 2024

Photophosphorylation involves the Photophosphorylation of ADP (adenosine diphosphate) to form ATP (adenosine triphosphate) using the energy derived from light during photosynthesis.

Thus (c) is correct option.

2. The individual flattened stacks of membranous structures inside the chloroplasts are known as:
 (a) Grana (b) Stroma
 (c) Thylakoids (d) Cristae

Ans :

MAIN 2016

Thylakoids consist of a thylakoid membrane surrounding a thylakoid lumen. Chloroplast thylakoids frequently form stacks of disks referred to as grana. So the correct option is 'Thylakoid'.

Thus (c) is correct option.

3. A biologist studies how ADP is converted to ATP during photosynthesis under different light conditions. The process of conversion of ADP to ATP during Photosynthesis :
 (a) Polymerisation.
 (b) Photophosphorylation.
 (c) Photorespiration.
 (d) Photolysis.

Ans :

SQP 2021

The process of conversion of ADP to form ATP using the energy of sunlight during the first phase of photosynthesis is termed as photophosphorylation.

Thus (b) is correct option.

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- 16.** What role do carotenoids play in photosynthesis?
- They produce oxygen
 - They absorb and transfer light energy to chlorophyll
 - They convert light energy into chemical energy
 - They break down chlorophyll

Ans :

COMP 2005

Carotenoids absorb light and transfer the energy to chlorophyll, aiding in the process of photosynthesis. They also protect chlorophyll from photo-oxidation.

Thus (b) is correct option.

- 17.** What is the source of hydrogen ions in photosynthesis?
- Carbon dioxide
 - Water
 - Oxygen
 - Chlorophyll

Ans :

SQP 2016

During photosynthesis, water is split in the light-dependent reactions, releasing hydrogen ions, electrons, and oxygen.

Thus (b) is correct option.

- 18.** Where does the light reaction of photosynthesis take place?
- Stroma
 - Cytoplasm
 - Thylakoids
 - Nucleus

Ans :

MAIN 2012

The light reaction of photosynthesis occurs in the thylakoids of the chloroplast where light energy is absorbed by chlorophyll and converted into chemical energy.

Thus, (c) is the correct option.

- 19.** What are the end products of the light reaction in photosynthesis?
- Oxygen and ATP
 - Oxygen, ATP, and NADPH
 - Carbon dioxide and water
 - Glucose and ATP

Ans :

COMP 2008

During the light reaction, water is split to produce oxygen, and ATP and NADPH are generated to be used in the dark reaction.

Thus, (b) is the correct option.

- 20.** What is the primary acceptor of atmospheric carbon dioxide in the dark reaction?
- 4RuBP
 - ATP
 - NADP
 - Chlorophyll

Ans :

SQP 2004

In the dark reaction, carbon dioxide is fixed by combining with Ribulose biphosphate (RuBP).

Thus, (a) is the correct option.

- 21.** The process of conversion of glucose into starch in plants is known as:
- Photophosphorylation
 - Polymerization
 - Photorespiration
 - Photolysis

Ans :

MAIN 2000

The conversion of soluble glucose into insoluble starch is called polymerization.

Thus, (b) is the correct option.

- 22.** What happens during photorespiration?
- Uptake of oxygen and production of carbon dioxide
 - Release of glucose
 - Uptake of carbon dioxide and release of oxygen
 - Absorption of chlorophyll

Ans :

COMP 2015

Photorespiration occurs when oxygen is taken up, and carbon dioxide is released, usually in the light.

Thus, (a) is the correct option.

- 23.** Which pigment is responsible for the green color in leaves and absorbs light for photosynthesis?
- Carotenoids
 - Chlorophyll
 - Xanthophylls
 - Anthocyanins

Ans :

SQP 2011

Chlorophyll is the green pigment that absorbs light energy for photosynthesis.

Thus, (b) is the correct option.

- 24.** In which phase of photosynthesis is carbon dioxide fixed into glucose?
- Light reaction
 - Dark reaction
 - Photolysis
 - Photorespiration

Ans :

MAIN 2007

It is because the snail can provide carbon dioxide for photosynthesis and it has got all requirements for its survival.

Thus (e) is correct option.

8. What is the main function of photosynthesis?
- To produce oxygen
 - To transduce light energy into chemical energy
 - To consume water and release carbon dioxide
 - To break down chlorophyll

Ans :

SQP 2018

Photosynthesis is the process where light energy is converted into chemical energy in the form of carbohydrates, which serve as food for plants and, indirectly, for other organisms.

Thus (b) is correct option.

9. Where does the majority of photosynthesis occur on Earth?
- In forests
 - In deserts
 - In oceans
 - In mountains

Ans :

MAIN 2014

Up to 90% of photosynthesis on Earth takes place in the oceans, mainly through phytoplankton and other aquatic plants.

Thus (c) is correct option.

10. What is the site of the light reaction of photosynthesis?
- Stroma
 - Thylakoid
 - Grana
 - Quantasome

Ans :

COMP 2010

Grana are stacks of thylakoids in the chloroplasts where the light-dependent reactions of photosynthesis occur.

Thus (d) is correct option.

11. Who discovered chloroplasts as the site of photosynthesis?
- Robert Brown
 - Robert Hill
 - Joseph Priestley
 - Julius von Sachs

Ans :

SQP 2006

Robert Hill discovered that the chloroplast is the site of photosynthesis, and the "Hill reaction"

is named after him, which refers to the light-dependent reactions of photosynthesis.

Thus (d) is correct option.

12. What is the functional unit of chloroplasts capable of absorbing light?
- Stroma
 - Thylakoid
 - Quantasome
 - Granum

Ans :

MAIN 2002

Quantasomes are small spherical structures on the thylakoid membrane that absorb light and are the functional units of chloroplasts involved in photosynthesis.

Thus (c) is correct option.

13. What pigment group primarily absorbs light for photosynthesis?
- Chlorophylls
 - Carotenes
 - Xanthophylls
 - Anthocyanins

Ans :

COMP 2017

Chlorophylls are the main pigments involved in absorbing light energy, which is then used in photosynthesis to produce carbohydrates.

Thus (a) is correct option.

14. Which pigment is responsible for the green color of plants?
- Chlorophyll
 - Carotene
 - Xanthophyll
 - Anthocyanin

Ans :

SQP 2013

Chlorophyll reflects green light, which gives plants their green color and is crucial for photosynthesis.

Thus (a) is correct option.

15. Which of the following is NOT a requirement for photosynthesis?
- Chlorophyll
 - Oxygen
 - Water
 - Carbon dioxide

Ans :

MAIN 2009

Oxygen is a byproduct of photosynthesis, not a requirement. The essential requirements are light, water, carbon dioxide, and chlorophyll.

Thus (b) is correct option.

The photosynthetic pigment chlorophyll carries this role.

2. MECHANISM OF PHOTOSYNTHESIS

Photosynthesis is an oxidation – reduction process in which water is oxidized to oxygen and carbon dioxide is reduced to carbohydrates. Mesophyll cells in the leaves are the main centre of photosynthesis and this process is not a single step process, rather it involves many steps. The various steps which are involved in photosynthesis are divided in two distinct but related phases. These are :

- (1) Light reaction (Photochemical phase or light dependent phase or Hill reaction).
- (2) Dark reaction (Biosynthetic phase or light independent phase or Blackmans reaction).

2.1 Light Reaction

This phase occurs in the thylakoids of chloroplast. In this phase light energy is absorbed by chlorophyll pigment and is converted into chemical energy which is stored in the energy rich ATP molecules. A substance NADP (Nicotinamide adenine dinucleotide phosphate) is converted into a reducing substance NADPH, which is generated at the same time.

There is photolysis of water which leads to the evolution of molecular oxygen. At the same time generation of ATP from ADP also occurs. This process is called photophosphorylation.

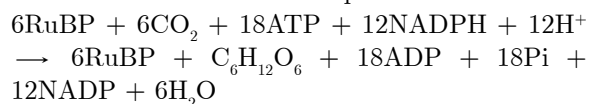
Hence, in light reaction the end products are NADPH and ATP which are further used in the dark reaction of photosynthesis to fix and reduce carbon dioxide.

2.2 Dark Reaction

Dark reaction does not mean that it takes place at night or darkness. It simply means that dark reaction does not require light energy. This stage occurs in the stroma of the chloroplast. Dark reaction involves the fixation and reduction of carbon dioxide resulting in the formation of carbohydrates by utilizing ATP and NADPH obtained as a result of the light reaction.

The primary acceptor of atmospheric carbon dioxide is RuBP (Ribulose bi phosphate) in the beginning of this stage. At the end of the cycle glucose is synthesized and RuBP is regenerated.

The Overall reaction of this phase is :



Glucose produced during photosynthesis is soluble in water and consists of small molecules. As soon as glucose is produced it is converted into starch (insoluble in water) by the process of polymerization.

3. PHOTORESPIRATION

The process of uptake of oxygen and production of carbon dioxide in light by photosynthesizing tissue is called photorespiration. A large proportion of carbon dioxide assimilated by photosynthesis is lost through photorespiration.

3.1 Adaptation in Leaf for Photosynthesis

To perform the function of photosynthesis efficiently, rapidly and sufficiently, the leaves undergo for some structural changes which are as follow :

Large surface area, leaf arrangement on stem, presence of chloroplasts, numerous stomata, thinness of leaf and network of veins.

3.2 Factors Influencing Photosynthesis

There are external as well as internal factors which affect the rate of photosynthesis. External factors include light, carbon dioxide, temperature, oxygen and water contents. Several aspects of leaf anatomy like thickness of cuticle, distribution of stomata and development palisade and vascular tissue also influence the rate of photosynthesis by influencing the diffusion of carbon dioxide through stomata.

Maximum photosynthesis occurs in red and blue light while in green light it is the least.

3.3 Translocation of Organic Compounds (Photosynthates) in Plants

The movement of organic matter from the place of its synthesis to other parts of the plant through special conducting tissue, the phloem, is called translocation of photosynthates.

Carbohydrates formed in photosynthesis are used up in three main ways :-

3.4 Fate of Carbohydrates Formed in Photosynthesis

1. **Respiration** : Most cells receive sugar through phloem. This is broken down during respiration to liberate energy the cells require.
2. **Food storage** : Some of the sugar may be stored for future use either in organs such as bulbs, tubers, corms or rhizomes or for the next generation in seeds or fruits. Usually the sugar is converted into starch for storage but

The dark reaction, also called the Calvin cycle, fixes carbon dioxide to form glucose.
Thus, (b) is the correct option.

- 25.** What is the source of hydrogen ions used during photosynthesis?

(a) Glucose
(b) Water
(c) Oxygen
(d) ATP

Ans : COMP 2003

Water is split during the light reaction to release hydrogen ions, electrons, and oxygen.
Thus, (b) is the correct option.

- 26.** Which light is least effective in photosynthesis?

(a) Red
(b) Blue
(c) Green
(d) Yellow

Ans : SQP 2014

Green light is least effective because chlorophyll reflects green light and does not absorb it.
Thus, (c) is the correct option.

- 27.** What is the function of carotenoids in photosynthesis?

(a) Absorb green light
(b) Protect chlorophyll from photo-oxidation
(c) Produce ATP
(d) Absorb carbon dioxide

Ans : MAIN 2010

Carotenoids absorb light and protect chlorophyll from photo-oxidation, preventing damage from excess light.

Thus, (b) is the correct option.

- 28.** Which element is not required for the process of photosynthesis?

(a) Light
(b) Carbon dioxide
(c) Water
(d) Nitrogen

Ans : COMP 2006

Explanation: Nitrogen is essential for plant growth but not directly required for photosynthesis.
Thus, (d) is the correct option.

- 29.** What gas is evolved during photosynthesis?

(a) Carbon dioxide (b) Oxygen
(c) Nitrogen (d) Methane

Ans : SQP 2002

Oxygen is produced during the photolysis of water in the light-dependent reactions of photosynthesis.
Thus, (b) is the correct option.

- 30.** What process in photosynthesis involves the formation of ATP from ADP and P_i using light energy?

(a) Photophosphorylation
(b) Photolysis
(c) Polymerization
(d) Photorespiration

Ans : MAIN 2013

Photophosphorylation is the process of generating ATP using light energy during the light-dependent reactions.

Thus, (a) is the correct option.

- 31.** Which molecule is regenerated at the end of the Calvin cycle?

(a) Glucose
(b) RuBP
(c) ATP
(d) NADPH

Ans : COMP 2009

Ribulose biphosphate (RuBP) is regenerated at the end of the Calvin cycle to accept more carbon dioxide.

Thus, (b) is the correct option.

- 32.** What experiment is commonly used to demonstrate that light is necessary for photosynthesis?

(a) Test with methylated spirit
(b) Ganong's light screen experiment
(c) Test with iodine
(d) Variegated leaf test

Ans : SQP 2005

Ganong's light screen experiment is used to demonstrate that light is necessary for photosynthesis by covering part of a leaf and showing that photosynthesis does not occur in the covered part.

Thus, (b) is the correct option.

- 33.** Which plants are used to demonstrate the evolution of oxygen during photosynthesis?

(a) Potato and tomato
(b) Hydrilla and Elodia
(c) Cacti and succulents
(d) Wheat and rice

Ans : MAIN 2002

Ans : COMP 1999
False

- 125.** The unit of light absorbed by the chlorophyll during photosynthesis is the proton.

Ans : MAIN 1997
False

- 126.** Photosynthesis stops to occur at a temperature above 35°C.

Ans : COMP 2004
False

- 127.** Photosynthesis occurs in all the cells of the plant.

Ans : SQP 2009
False

- 128.** Photolysis is the process of splitting of water molecules in the presence of grana and temperature.

Ans : MAIN 2010
False. Photolysis is the process of splitting of water molecules in the presence of grana and light.

- 129.** The ultimate electron donor in photosynthesis is water.

Ans : COMP 2022
True

- 130.** Light dependent reactions of photosynthesis occur in stroma of chloroplast.

Ans : SQP 2017
False

- 131.** Plants can be destarched by keeping in dark for 10 hours.

Ans : COMP 2014
False

- 132.** In a leaf photosynthesis occurs mainly in spongy mesophyll.

Ans : MAIN 2000
False

- 133.** Photosynthesis stops to occur at temperature above 35 degree centigrade.

Ans : COMP 2005
True.

- 134.** The solvent used to dissolve the chlorophyll pigments while testing a leaf for starch is Soda lime.

Ans : MAIN 2007
False. The solvent used to dissolve the chlorophyll pigments while testing a leaf for starch is methylated spirit/methyl alcohol.

- 135.** The dark reaction of photosynthesis is light independent.

Ans : SQP 2016
True.

- 136.** Land plants obtain their carbon dioxide from the atmosphere.

Ans : COMP 2023
True.

- 137.** In a typical leaf, photosynthesis occurs mainly in spongy mesophyll.

Ans : SQP 2021
False. In a typical leaf, photosynthesis occurs mainly in palisade cells.

- 138.** Photosynthesis occurs in all plants.

Ans : MAIN 2010
False. Respiration occurs in all plants.

- 139.** Oxygen is necessary for photosynthesis.

Ans : SQP 2014
False. Carbon dioxide is necessary for photosynthesis.

- 140.** Plants can be destarched by keeping in dark for 48 hours.

Ans : MAIN 2020
True.

- 141.** Carbon dioxide is a life supporting gas produced during photosynthesis.

Ans : MAIN 2022
False. Oxygen is a life supporting gas produced during photosynthesis.

- 142.** KOH absorbs carbon dioxide.

Ans : SQP 2015
True.

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- (iv) In what manner do the leaves 1 and 2 differ at the end of the starch test ?
- Leaf 1 turns brown, Leaf 2 turns blue black.
 - Leaf 1 turns blue black, Leaf 2 turns brown.
 - Leaf 1 turns purple, Leaf 2 remains green.
 - There is no change in the colour of the leaves.

Ans :

MAIN 2021

Thus (a) is correct option.

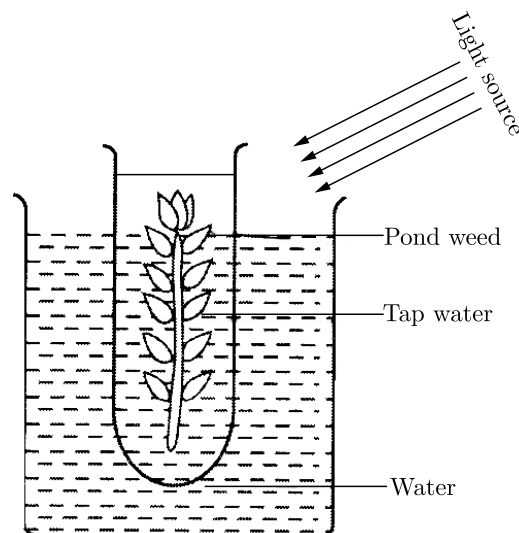
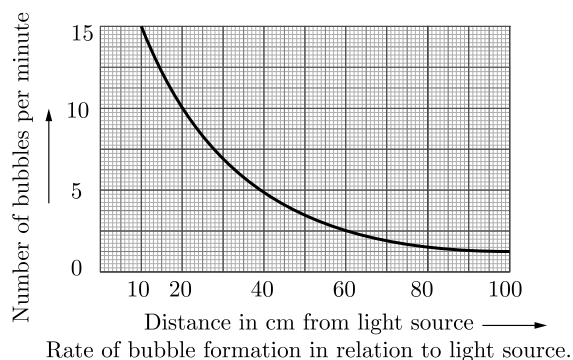
- (v) What is the important step that should be taken before performing this experiment ?
- The plant should be placed in dark for 24 hours to destarch the entire plant.
 - The plant should be placed in dark for 24 hours to remove chlorophyll from the leaves.
 - The plant should be placed in dark for 24 hours to destarch the leaves.
 - The plant should be placed in dark for 24 hours for the roots to absorb water.

Ans :

MAIN 2021

Thus (c) is correct option.

39. The diagram refers to an experiment in which the apparatus was set up with the light source kept away from the plant. After 15 minutes the number of bubbles evolved per minute from the cut stem was recorded. The light source was moved to 20 cm away from the plant, left for 15 minutes and the number of bubbles evolved per minute was again recorded. The experiment was again recorded. The experiment was repeated with the light source at distance of 40, 60, 80, 100 cm away from the plant. The results obtained were recorded on the graph : Select the correct answer out of the available choice given under each question :



- (i) From the graph it seems likely that the rate of bubbling per minute at 50 cm would have been:
- 2.0
 - 2.5
 - 3.0
 - 3.5
 - 4.0

Ans :

SQP 2020

Thus (d) is correct option.

- (ii) The gas produced by the plant during the experiment was :
- air
 - oxygen
 - carbon dioxide
 - nitrogen
 - hydrogen

Ans :

SQP 2020

Thus (b) is correct option.

- (iii) The gas collected comes due to the breakdown of :
- glucose
 - starch
 - water
 - air
 - ATP.

Ans :

SQP 2020

Thus (c) is correct option.

- (iv) If ice cubes were added to the water, the rate of bubble formation would :
- stay the same.
 - increase because more water is added.
 - decrease because the temperature drops.
 - decrease because water freezes.
 - cannot tell from the information given.

Ans :

SQP 2020

Thus (c) is correct option.

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Identify the correct pair of hormones:

- (a) P – Glucagon, Q – Erythropoietin
- (b) P – Oxytocin, Q – Vasopressin
- (c) P – Insulin, Q – Parathyroid Hormone
- (d) P – Adrenaline, Q – Glucagon

Ans :

COMP 2016

Glucagon stimulates the release of insulin by breaking down glycogen, and erythropoietin increases the production of red blood cells.

Thus, (a) is the correct option.

51. Neha matched the hormones with their effects as shown below:

Hormone	Effect on the body
P	Promotes the release of glucose into the bloodstream
Q	Controls the body's metabolism rate

Identify the correct pair of hormones:

- (a) P – Glucagon, Q – Thyroxine
- (b) P – Vasopressin, Q – Oxytocin
- (c) P – Glucagon, Q – Vasopressin
- (d) P – Insulin, Q – Thyroxine

Ans :

SQP 2012

Glucagon promotes the release of glucose into the bloodstream, and thyroxine controls the body's metabolism rate.

Thus, (a) is the correct option.

DIRECTION : Name the following :

52. The structure where photophosphorylation takes place.

Ans :

MAIN 2005

Thylakoid/grana

53. The part of the chloroplast where the light reaction of photosynthesis takes place.

Ans :

COMP 2011

Grana

54. Plants that prepare their own food from basic raw materials.

Ans :

SQP 1999

Autotrophs

55. The cell organelle responsible for photosynthesis.

Ans :

MAIN 2009

Chloroplast

56. The process of conversion of ADP into ATP during photosynthesis.

Ans :

SQP 2011

Photophosphorylation

57. The site of dark reaction of photosynthesis.

Ans :

COMP 2021

Stroma

58. The organisms which convert complex organic matter into simple ones.

Ans :

MAIN 2023

Decomposers

59. The only biological process that releases oxygen into the air.

Ans :

SQP 2019

Photosynthesis

60. The food produced by green plants.

Ans :

MAIN 2005

Glucose

61. The cell organelle/principle site responsible for photosynthesis.

Ans :

COMP 2000

Chloroplast

62. The ground substance present in a chloroplast.

Ans :

MAIN 2008

Stroma

63. The chemical used to test starch.

Ans :

SQP 2010

Iodine

64. The process by which green plants prepare their own food.

Ans :

SQP 2017

Photosynthesis

65. The products of photosynthesis.

Ans :

MAIN 2020

Glucose, water and oxygen

66. A plant that does not perform photosynthesis.

Ans :

COMP 2023

Mushroom/Fungus

45. The teacher asked students to name two organs in the human respiratory system.

Raj said: Lungs and Diaphragm

Sonu said: Lungs and Kidney

Lata said: Trachea and Alveoli

Abhay said: Heart and Lungs

Who were correct?

- (a) Raj and Lata
- (b) Sonu and Abhay
- (c) Lata and Abhay
- (d) Raj and Sonu

Ans :

SQP 2009

The lungs, diaphragm, trachea, and alveoli are part of the respiratory system, while the kidneys and heart are not. Raj and Lata are correct.

Thus, (a) is the correct option.

46. A teacher asked students to give two examples of elements.

Raj said: Gold and Oxygen

Sonu said: Hydrogen and Carbon Dioxide

Lata said: Nitrogen and Silver

Abhay said: Carbon and Water

Who were correct?

- (a) Raj and Lata
- (b) Sonu and Abhay
- (c) Raj and Sonu
- (d) Lata and Abhay

Ans :

MAIN 2004

Gold, oxygen, hydrogen, nitrogen, silver, and carbon are elements, while carbon dioxide and water are compounds. Therefore, Raj and Lata are correct.

Thus (a) is the correct option.

DIRECTION : Matching Type Question

47. Ravi tried to match the hormones with their effects on the human body. He tabulated the pairs as follows:

Hormone	Effect on the body
P	Lowers blood sugar by converting glucose into glycogen
Q	Increases heart rate and boosts energy

Identify the correct pair of hormones:

- (a) P – Insulin, Q – Glucagon
- (b) P – Insulin, Q – Adrenaline
- (c) P – Glucagon, Q – Vasopressin
- (d) P – Oxytocin, Q – Adrenaline

Ans :

COMP 2008

Insulin lowers blood sugar by converting glucose into glycogen, and adrenaline is known for increasing heart rate and boosting energy.

Thus, (b) is the correct option.

Anita matched the hormones with their roles in the body. The table below shows her result:

Hormone	Effect on the body
P	Promotes water reabsorption in kidneys
Q	Regulates growth and development of bones

Identify the correct pair of hormones:

- (a) P – Adrenaline, Q – Glucagon
- (b) P – Vasopressin, Q – Growth Hormone
- (c) P – Insulin, Q – Adrenaline
- (d) P – Oxytocin, Q – Adrenaline

Ans :

SQP 2002

Vasopressin promotes water reabsorption in the kidneys, and growth hormone regulates the growth and development of bones.

Thus, (b) is the correct option.

49. Sam matched the hormones with their functions as follows:

Hormone	Effect on the body
P	Stimulates milk production in mammals
Q	Raises blood calcium levels

Identify the correct pair of hormones:

- (a) P – Prolactin, Q – Parathyroid Hormone
- (b) P – Adrenaline, Q – Thyroxine
- (c) P – Glucagon, Q – Vasopressin
- (d) P – Vasopressin, Q – Oxytocin

Ans :

MAIN 2020

Prolactin stimulates milk production in mammals, and parathyroid hormone raises blood calcium levels.

Thus, (a) is the correct option.

50. Vikram matched the following hormones with their roles:

Hormone	Effect on the body
P	Stimulates the release of insulin
Q	Increases the production of red blood cells

- (v) If some sodium bicarbonate is added to the water, the rate of bubble formation :
- increases because more respiration occurs.
 - increases because more photosynthesis occurs.
 - increases because the gas becomes less soluble.
 - decreases because carbon dioxide acts as a limiting factor.
 - decreases because respiration decreases.

Ans :

SQP 2020

Thus (b) is correct option.

40. A plant physiologist is investigating the effects of de-starching on a plant. The plant is treated to remove stored starch from certain parts before conducting experiments on photosynthesis. A de-starched plant is one whose:
- leaves are free from chlorophyll
 - aerial parts are free from starch
 - leaves are free from starch
 - plant is free from starch.

Ans :

MAIN 2012

In the process of de-starching, a plant is placed in the dark for 24 to 48 hours, which allows the plant to utilize its stored starch reserves. This ensures that the plant's leaves are free from starch, making it ideal for experiments involving photosynthesis. De-starching does not involve the removal of chlorophyll or starch from all parts of the plant; rather, it specifically removes starch from the leaves where photosynthesis occurs. Thus (c) is correct option.

41. A plant is kept in a dark cupboard for about 48 hours before conducting an experiment on photosynthesis to:
- Remove starch from the plant.
 - Ensure that starch is not translocated from the leaves.
 - Remove chlorophyll from the leaf of the plant.
 - Remove starch from the experimental leaf.

Ans :

SQP 2016

Keeping a plant in the dark for 48 hours depletes the starch in its leaves, ensuring they are starch-free for the experiment. This step helps confirm whether starch is produced during photosynthesis in the experiment. Thus (d) is correct option.

DIRECTION : Conversation Type Question

42. A biology teacher asked her students to identify two examples of mammals.

Raj said: Cat and Dog

Sonu said: Frog and Whale

Lata said: Bat and Elephant

Abhay said: Eagle and Dolphin

Who were correct?

- Abhay and Sonu
- Raj and Lata
- Sonu and Lata
- Raj and Abhay

Ans :

SQP 2010

Cats, dogs, bats, and elephants are all mammals. Frogs are amphibians, and eagles are birds, so Sonu and Abhay are incorrect. Thus, (b) is the correct option.

43. The teacher asked students to give two examples of amphibians.

Raj said: Frog and Salamander

Sonu said: Turtle and Toad

Lata said: Frog and Toad

Abhay said: Salamander and Crocodile

Who were correct?

- Lata and Raj
- Raj and Abhay
- Sonu and Lata
- Raj and Sonu

Ans :

MAIN 2006

Explanation: Frogs, toads, and salamanders are amphibians, while turtles and crocodiles are reptiles, making Lata and Raj correct. Thus, (a) is the correct option.

44. The teacher asked her class for two examples of plants that perform photosynthesis.

Raj said: Cactus and Mushroom

Sonu said: Fern and Pine

Lata said: Rose and Cactus

Abhay said: Mushroom and Fern

Who were correct?

- Raj and Abhay
- Sonu and Lata
- Raj and Sonu
- Lata and Sonu

Ans :

COMP 2002

Mushrooms do not perform photosynthesis because they are fungi, while plants like ferns, pine, roses, and cacti do. Therefore, Sonu and Lata are correct.

Thus, (b) is the correct option.

- 67.** A gas released by green plants during photosynthesis.
Ans : SQP 2018
 Oxygen
- 68.** The raw materials needed for photosynthesis.
Ans : MAIN 2005
 Carbon dioxide and water.
- 69.** The reaction by which the water molecules are broken down by means of light.
Ans : COMP 2008
 Photolysis
- 70.** The first stable product formed during CO_2 fixation.
Ans : MAIN 2013
 Phosphoglyceric Acid (PGA)
- 71.** The experiment to demonstrate the importance of light for photosynthesis.
Ans : SQP 2002
 Light screen experiment
- 72.** The energy currency of the cell.
Ans : SQP 2000
 ATP
- 73.** The substance from which oxygen is evolved during photosynthesis.
Ans : MAIN 2009
 Water
- 74.** The organisms which can prepare their own food.
Ans : MAIN 2016
 Autotrophs
- 75.** The substance which capture photons in plants.
Ans : SQP 2022
 Chlorophyll
- 76.** The organisms which convert complex organic matter into simple forms.
Ans : MAIN 2014
 Decomposers
- 77.** The starting point of all food chains.
Ans : COMP 2018
 Green plants
- 78.** The process of conversion of complex organic matter into simple forms by microorganisms.
Ans : COMP 2006
 Decay
- 79.** The immediate product of photosynthesis.
Ans : MAIN 2003
 Glucose
- 80.** Damage of photosynthetic apparatus at very high temperature.
Ans : COMP 2019
 Solarization
- 81.** Any two plants which do not perform photosynthesis.
Ans : SQP 2014
 Cuscuta ; Mushroom
- 82.** The part of chloroplast where light reaction occurs.
Ans : MAIN 2022
 Grana
- 83.** The chemical reaction in which oxygen is given out.
Ans : MAIN 2016
 Photolysis of water
- 84.** Organelles that transform radiant energy in to the molecules of organic compounds.
Ans : COMP 2012
 Chloroplasts
- 85.** The chemical that absorbs carbon dioxide during dark reaction.
Ans : MAIN 2010
 Ribulose bi phosphate
- 86.** The colour or rays in which the rate of photosynthesis is highest next to red.
Ans : SQP 2019
 Blue
- 87.** The colour in which the rate of photosynthesis is minimum.

Ans :

MAIN 2011

Green

88. The chemical used to test starch.

Ans :

COMP 2008

Iodine

89. The type of leaf which is used to demonstrate that chlorophyll is necessary for photosynthesis.

Ans :

SQP 2001

Variegated leaf

90. The plastids found in cells of yellow coloured petals.

Ans :

MAIN 2003

Chromoplast

91. The ground substance present in chloroplast.

Ans :

COMP 2012

Stroma/Matrix

DIRECTION : Complete the following:

92. Splitting of water results in the release of _____.

Ans :

MAIN 2011

oxygen

93. Starch can be tested by _____

Ans :

SQP 2015

iodine

94. Xanthophyll is _____ coloured pigment.

Ans :

SQP 2020

yellow

95. Carbon dioxide enters the leaf through _____.

Ans :

MAIN 2012

stomata

96. Dark reaction takes place in the _____ of the chloroplast.

Ans :

COMP 2000

stroma of chloroplast

97. _____ are regarded as complete photosynthetic units of plants.

Ans :

SQP 2004

Chloroplasts

98. The splitting of water molecules by photons is called _____.

Ans :

MAIN 2009

photolysis

99. In photosynthesis, _____ is reduced and _____ is oxidised.

Ans :

SQP 2017

CO₂, water

100. In photosynthesis, radiant energy is converted into _____.

Ans :

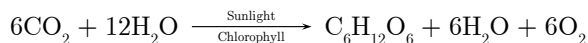
MAIN 2001

chemical energy

101. _____ + 12H₂O $\xrightarrow[\text{Chlorophyll}]{\text{Sunlight}}$ C₆H₁₂O₆ + _____ + _____.

Ans :

SQP 2012



102. Calvin cycle was proposed by _____.

Ans :

COMP 2015

Melvin Calvin

103. _____ is the process which replenishes the atmospheric oxygen which the animal life consumes in respiration.

Ans :

MAIN 2008

Photosynthesis

104. Light reaction of photosynthesis takes place in _____.

Ans :

SQP 2013

grana of chloroplasts

105. ATP stands for _____.

Ans :

MAIN 2010

Adenosine triphosphate

106. The light independent reactions of photosynthesis are also known as _____ phase.

Ans :

SQP 2007

Biosynthetic

107. Chlorophyll is present in the _____ of chloroplasts.

Ans :

COMP 2023

Thylakoids

- 108.** The smaller unit of light energy is _____

Ans : MAIN 2020

Photons

- 109.** In photophosphorylation, a energy is needed to add phosphate to _____

Ans : SQP 2011

ADP

- 110.** _____ stores energy in a cell.

Ans : COMP 2014

ATP

- 111.** The thinness of leaf _____ photosynthesis.

Ans : SQP 2016

increases

- 112.** The stored form of glucose is _____.

Ans : SQP 2002

starch

- 113.** Light energy is trapped by _____.

Ans : MAIN 2018

chlorophyll

- 114.** _____ and _____ are formed during photolysis.

Ans : COMP 2003

H^+ , $(OH)^-$

- 115.** _____ colour forms when iodine is added to starch.

Ans : SQP 2021

Blue-black

- 116.** Photosynthesis involves light reaction and dark reaction. During light reaction, the chlorophyll present in the (1)_____ gets activated by absorbing light energy. This energy splits (2)_____ molecules to (3)_____ and oxygen and releases two electrons. This process is called (4)_____. The (5)_____ ions are picked up by NADP to form (6)_____. The ADP is converted to (7)_____. This process is called (8)_____. During the dark phase, the compound produced at the end of light reaction reacts with carbon dioxide to form (9)_____.

This product is converted to starch. The process is called (10)_____.

Ans :

COMP 2007

- | | |
|------------------|---------------------------|
| (1) leaves | (2) water |
| (3) hydrogen ion | (4) photolysis. |
| (5) hydrogen | (6) $NADPH_2$. |
| (7) ATP. | (8) photophosphorylation. |
| (9) glucose. | (10) polymerisation. |

DIRECTION : Give exact location and function :

- 117.** Thylakoids

Ans :

SQP 2005

Granum of chloroplast. Help in trapping sunlight (photosynthesis).

- 118.** Grana

Ans :

MAIN 1999

Inside chloroplast. Help in trapping sunlight.

- 119.** Guard cell

Ans :

COMP 2001

Around stomata mostly under the surface of a dorsiventral leaf. Allow diffusion of gases.

- 120.** Stoma

Ans :

COMP 2006

Epidermis of leaves. Exchange of gases for photosynthesis/respiration/loss of water as water vapour during transpiration.

DIRECTION : State true or false

- 121.** Photosynthesis occurs in all the cells of a plant.

Ans :

MAIN 2005

False

- 122.** Stomata is stimulated by light.

Ans :

COMP 2002

True

- 123.** Grana helps in diffusion of gases.

Ans :

MAIN 2007

False

- 124.** Photosynthesis results in the loss of dry weight of the plant.

Hydrilla and Elodia are aquatic plants used in experiments to demonstrate oxygen evolution during photosynthesis.

Thus, (b) is the correct option.

- 34.** Which pigment breaks down first in leaves before leaf fall, revealing carotenoids?
- Chlorophyll
 - Xanthophyll
 - Anthocyanin
 - Carotene

Ans :

COMP 2012

Chlorophyll breaks down first in leaves before leaf fall, revealing the yellow and red pigments of carotenoids.

Thus, (a) is the correct option.

- 35.** What happens to carbohydrates formed during photosynthesis?
- They are released as oxygen.
 - They are used in respiration, storage, and growth.
 - They are converted to nitrogen compounds.
 - They are absorbed by roots.

Ans :

SQP 2008

Carbohydrates produced during photosynthesis are used for respiration, stored for later use, or used for growth.

Thus, (b) is the correct option.

- 36.** What are the primary products formed in the light reaction of photosynthesis?
- ATP and oxygen
 - ATP and NADPH
 - Carbon dioxide and glucose
 - ADP and oxygen

Ans :

MAIN 2004

The light reactions produce ATP and NADPH, which are used in the Calvin cycle to fix carbon dioxide into glucose.

Thus, (b) is the correct option.

- 37.** What solution is used to test for the presence of starch in leaves?
- Methylated spirit
 - Iodine
 - Benedict's solution
 - Hydrochloric acid

Ans :

COMP 2011

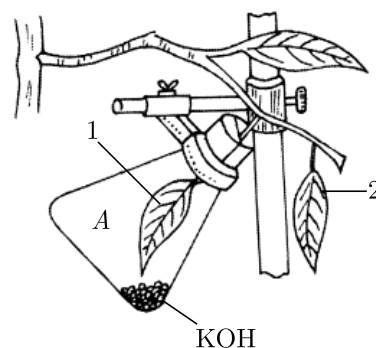
Iodine solution turns blue-black in the presence of starch, indicating that photosynthesis has

occurred.

Thus, (b) is the correct option.

DIRECTION : Case Base Question

- 38.** The diagram given below represents an experiment to demonstrate a particular aspect of Photosynthesis. The letter 'A' indicates a certain condition inside the flask. Answer the questions :



- What is the aim of the experiment ?
 - To show that oxygen is released during Photosynthesis.
 - To show that Photosynthesis occurs in the presence of KOH.
 - To show that chlorophyll is necessary for Photosynthesis.
 - To show that carbon dioxide is necessary for Photosynthesis.

Ans :

MAIN 2021

Thus (d) is correct option.

- What is the special condition inside the flask?
 - Air inside the flask is free of oxygen.
 - Air inside the flask is free of carbon dioxide.
 - Air inside the flask is free of nitrogen.
 - KOH purifies the air inside the flask.

Ans :

MAIN 2021

Thus (b) is correct option.

- An alternative chemical that can be used instead of KOH is :
 - Sodium hydroxide.
 - Sodium chloride.
 - Potassium chloride.
 - Potassium permanganate.

Ans :

MAIN 2021

Thus (a) is correct option.

- 143.** Photosynthesis stops to occur at temperature above 40°C.

Ans : COMP 2018
True.

- 144.** Starting point of a food chain is a plant.

Ans : MAIN 2009
True.

- 145.** Photosynthesis takes place in chromoplast.

Ans : SQP 2013
False. Photosynthesis takes place in chloroplast.

- 146.** Biosynthetic phase needs no light.

Ans : COMP 2010
True.

- 147.** Plants produce starch as food.

Ans : COMP 2002
False. Plants produce glucose as food.

- 148.** Consumers are also called as heterotrophs.

Ans : MAIN 2000
True.

- 149.** Photosynthesis needs an optimum temperature.

Ans : SQP 2005
True.

- 150.** Food is translocated by xylem.

Ans : COMP 2013
False. Food is translocated by phloem.

- 151.** Plants that manufacture their own food are called heterotrophs.

Ans : MAIN 2020
False. Plants that manufacture their own food are called autotrophs.

DIRECTION : Rewrite the correct form of statement by inserting a suitable word/words at right place. Do not delete any word in the statement :

- 152.** Destarching a plant means removing the starch from the plant.

Ans : COMP 2005
Destarching the plant means removing the starch

from the leaves of plant.

- 153.** The splitting of water molecules into hydrogen and hydroxyl ions is termed photolysis.

Ans : MAIN 2005
The splitting of water molecules into hydrogen and hydroxyl ions by light is termed photolysis.

DIRECTION : Correct the following statement by changing the underlined word :

- 154.** Xylem transports starch from the leaves to all parts of the plant body.

Ans : SQP 2018
Phloem

- 155.** The solvent used to dissolve the chlorophyll pigments while testing a leaf for starch is Soda lime.

Ans : MAIN 2017
The solvent used to dissolve the chlorophyll pigments while testing a leaf for starch is Methylated spirit/Alcohol

DIRECTION : Give biological reasons :

- 156.** A tiger owes its existence to chlorophyll.

Ans : COMP 2004
Green plants synthesise food by photosynthesis using chlorophyll. Tiger feeds on animal which feed on green plants thus they obtain their food indirectly from green plants.

- 157.** Photosynthesis is considered as a process supporting all life on earth.

Ans : SQP 2011
Green plants synthesise food by photosynthesis using chlorophyll. Carnivores feed on animals which feed on green plants thus they obtain their food directly or indirectly by photosynthesis.

- 158.** All the food chains begin with green plants.

Ans : MAIN 2018
All food chains begin with green plants as they manufacture food for all living organisms by photosynthesis.

- 159.** All life on Earth is supported by Photosynthesis.

Ans :

SQP 2019

Provides oxygen for respiration. Provides food and maintains food chain.

- 160.** Complete the following process to show how the oxygen in the air reaches a mesophyll cell of the leaf.

Oxygen in air $\longrightarrow$ --- $\longrightarrow$ --- $\longrightarrow$
Mesophyll cell.

Ans :

COMP 2004

Stoma, substomatal space.

DIRECTION : Choose the correct alternative :

- 161.** A plant is kept in a dark cupboard for about 48 hours before conducting any experiment on photosynthesis to (remove chlorophyll from leaves, remove starch from the plant, ensure that no photosynthesis occurs, ensure that leaves are free from starch.)

Ans :

MAIN 2002

Ensure that leaves are free from starch.

- 162.** The site of light reaction in the cells of a leaf is (grana, cytoplasm, stroma).

Ans :

SQP 2001

Grana.

- 163.** The chemical substance used to test the presence of starch in the cell of a leaf is (cobalt chloride paper, iodine solution, Benedict's solution).

Ans :

MAIN 2001

Iodine solution.

- 164.** The specific function of light energy in the process of photosynthesis is to (reduce carbon dioxide, synthesise glucose, activate chlorophyll, split water).

Ans :

COMP 2000

Activate chlorophyll.

- 165.** If the rate of respiration becomes more than the rate of photosynthesis plants will (continue to live but will not be able to store food, be killed instantly, grow more vigorously because more energy will be available, stop growing and gradually die of starvation).

Ans :

MAIN 1998

Stop growing and gradually die of starvation.

- 166.** Which one of these reaction occurs during photosynthesis ? (carbon dioxide is reduced and water is oxidized, water is reduced and carbon dioxide is oxidized, carbon dioxide and water both are oxidized, carbon dioxide and water both are reduced).

Ans :

SQP 1998

Carbon dioxide is reduced and water is oxidized.

- 167.** A destarched plant is one whose (leaves are free from chlorophyll, aerial parts are free from starch, leaves are free from starch, plant is free from starch).

Ans :

COMP 2009

Leaves are free from starch.

- 168.** Which of the following lights are the most effective for photosynthesis ? (green, yellow, blue, red, yellow and violet).

Ans :

MAIN 2019

Blue and red

- 169.** Sunlight arrives at a plant in units of light energy called (protons, photons, electrons, wavelengths).

Ans :

SQP 2012

Photons

- 170.** Which of the following is not a useful function of the light reaction in photosynthesis? (Splitting water, Synthesis of NADPH, Converting light energy into chemical energy, Releasing oxygen for photorespiration).

Ans :

COMP 2022

Releasing oxygen for photorespiration

- 171.** The conversion of ADP into ATP in presence of light.

Ans :

SQP 2017

Photophosphorylation

- 172.** The raw material for photosynthesis which gets reduced.

Ans :

MAIN 2012

Carbon dioxide

- 173.** The electron acceptor in light reaction of photosynthesis.

Ans :

SQP 2016

Nicotinamide adenine dinucleotide phosphate

174. The energy currency of the cell.

Ans :

COMP 2020

Adenosine triphosphate.

DIRECTION : Rewrite the terms in correct order in a logical sequence:

175. Water molecules, oxygen, grana, hydrogen and hydroxyl ions, photons.

Ans :

MAIN 2001

Photons, grana, water molecules, hydrogen and hydroxyl ion, oxygen.

DIRECTION : Mention one point of difference

176. Respiration and photosynthesis (Reactants).

Ans :

SQP 1996

Respiration – Glucose and oxygen

Photosynthesis – Carbon dioxide and water

177. Light reaction and Dark reaction. (site of occurrence).

Ans :

MAIN 2010

Light reaction : It occurs in the granal thylakoids of the chloroplast.

Dark reaction : It occurs in the stroma or ground matrix of the chloroplast.

DIRECTION : Fill in the blanks :

178. Chloroplasts and _____

Ans :

COMP 1998

Photosynthesis.

179. Mitochondria and _____

Ans :

SQP 2010

Respiration

DIRECTION : Copy and complete the following by filling in the blanks 1 to 5 with appropriate words / terms/phrases :

180. To test the leaf for starch, the leaf is boiled in water to _____(1). It is next boiled in methylated spirit to _____(2). The leaf is placed in warm water to soften it. It is then placed in a dish, and _____(3) solution is added. The

region, which contains starch, turns _____(4) and the region, which does not contain starch, turns _____(5).

Ans :

SQP 2011

- (1) Kill the cells
- (2) Removal of chlorophyll
- (3) Iodine
- (4) Blue - black colour
- (5) Brown colouration

DIRECTION : Give the biological/technical term for the following :

181. Process of conversion of several molecules of glucose to one molecule of starch.

Ans :

MAIN 2010

Polymerisation.

DIRECTION : Given below are sets of five terms each. Rewrite the terms in correct order in a logical sequence. Example : Large intestine, Stomach, Mouth, Small intestine, Oesophagus. Answer : Mouth → Oesophagus → Stomach → Small intestine → Large intestine.

182. Caterpillar, Snake, Owl, Frog, Green leaves.

Ans :

COMP 2017

Green leaves → Catterpillar → Frog → Snake → Owl.

DIRECTION : Answer the following :

183. Mention the significance of the following minerals:

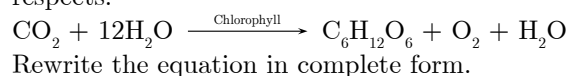
- (a) Iodine in our food.
- (b) Magnesium for green plants.

Ans :

SQP 2025

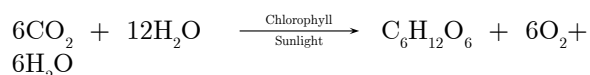
- (a) For synthesis of thyroxine by Thyroid gland
- (b) For synthesis of chlorophyll.

184. Given below is the overall chemical equation of photosynthesis which is incomplete in certain respects:



Ans :

MAIN 2025, 2001



- 248.** Plant is boiled in methylated spirit to _____.
[to remove starch, to remove chlorophyll, to kill cells, all of these]

Ans : MAIN 2019

remove chlorophyll.

- 249.** A destarched plant means [its leaves are without chlorophyll, plant is without chlorophyll, plant is without starch, aerial parts (mainly leaves) are without starch].

Ans : SQP 2022

its aerial parts (leaves) are without starch.

- 250.** Example of a decomposer. [Earthworm, Insect, Fungi, Snail]

Ans : COMP 2011

Fungi

DIRECTION : Give a logical reason for the following:

- 251.** ATP is needed for dark reaction.

Ans : MAIN 2023

Since ATP provides energy for dark reaction.

- 252.** Chloroplasts are called energy converters.

Ans : SQP 2018

Since chlorophyll present in chloroplasts trap solar energy and converts it into chemical energy.

- 253.** Respiration is said to be reversal of photosynthesis.

Ans : SQP 2012

Because respiration is a catabolic process while photosynthesis is an anabolic process.

- 254.** Chlorophyll is necessary for photosynthesis.

Ans : COMP 2010

Chlorophyll traps solar energy and converts it into chemical energy.

DIRECTION : Completed the following sentences with appropriate words.

- 255.** The first step in the process of photosynthesis is:
[absorption of light by chlorophyll, production of ATP, release of oxygen, fixation of CO₂]

Ans : SQP 2002

Absorption of light energy by chlorophyll.

- 256.** The specific function of light energy in photosynthesis is to [Synthesize glucose, activate chloroplast, split water, reduce carbon dioxide]

Ans : MAIN 2014

Split water.

- 257.** Formation of ATP from ADP is termed as [Photophosphorylation, phosphorylation, photolysis, photosynthesis]

Ans : COMP 2009

Photophosphorylation.

- 258.** During photosynthesis, how many water molecules are required to form one molecule of glucose?
[Twelve, ten, six, four]

Ans : SQP 2019

Twelve.

- 259.** Oxygen in glucose comes from which of these during photosynthesis.
[water, CO₂, air, both water and CO₂]

Ans : MAIN 2023

Water.

DIRECTION : Give exact location and function of the following :

- 260.** Stomata

Ans : SQP 2001

It is present in the epidermis of leaves. It helps in exchange of gases for photosynthesis, respiration and also helps in transpiration.

- 261.** Grana

Ans : MAIN 2019

Found in chloroplast. It is the site of light reaction of photosynthesis.

- 262.** Guard cells

Ans : COMP 2011

Found in the epidermis of leaves around the stomata. It controls the opening and closing of stomata.

- 263.** Thylakoids

Ans : COMP 2017

Inside the chloroplast in the form of piles to form granum. It helps to trap sunlight and initiates the process of photosynthesis.

199. What is photophosphorylation?

Ans : SQP 2021

It is the conversion of ADP with inorganic phosphate group to ATP in the presence of light.

200. What are thylakoids?

Ans : MAIN 2014

These are disc-shaped membranous sacs present in grana of the chloroplast.

201. How does the raw materials reach the plant cell?

Ans : COMP 2018

The raw materials required by plants are water, CO₂ and sunlight. Water enters into the leaf through the midrib and veins from the stem and root. CO₂ enters through the stomata from the atmosphere.

202. How does sunlight affects photosynthesis?

Ans : SQP 2020

Light provides energy for photosynthesis. Light intensity is directly proportional to photosynthesis.

203. State the role of ATP.

Ans : MAIN 2007

ATP provides energy for all biosystems to function. It is the energy currency of the cell.

204. What is NADP?

Ans : COMP 2003

It is an enzyme. Its full form is Nicotinamide Adenine Dinucleotide Phosphate. During electron transfer, NADP gets reduced to NADPH₂.

205. Where does photosynthesis mostly take place in a plant?

Ans : MAIN 2016

In plants, photosynthesis takes place in chloroplasts present in the leaf.

206. What is the optimum temperature for photosynthesis?

Ans : SQP 2010

30-35°C is the optimum temperature needed for photosynthesis.

207. What is photosynthesis?

Ans : MAIN 2023

The manufacturing of glucose by green plants with the help of carbon dioxide and water in the presence of sunlight and chlorophyll.

208. Mention two significant advantages of photosynthesis to the living world as a whole.

Ans : SQP 2017

- (a) To provide food for all organisms.
- (b) To release oxygen which is a life supporting gas.

209. What are the end products of light reaction?

Ans : COMP 2009

Oxygen, NADPH, ATE

210. What is biosynthetic phase?

Ans : MAIN 2019

It is called dark reaction which occurs in the stroma of chloroplast in absence of light (light is not required), and glucose is produced.

211. What is photolysis?

Ans : COMP 2014

The process of splitting of water by sunlight during light reaction is called photolysis.

212. Light reaction is also called photochemical reaction. Why?

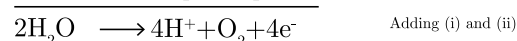
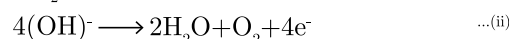
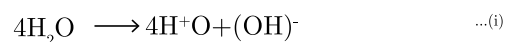
Ans : SQP 2011

Light reaction takes place in the grana of chloroplast in presence of light, so it is called photochemical reaction.

213. State the role of chlorophyll.

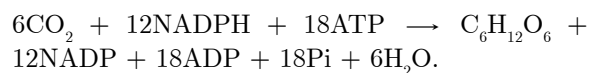
Ans : MAIN 2004

Chlorophyll absorbs photons of sunlight, gets excited and helps in the splitting of water molecules into hydrogen ions and hydroxyl ions.



214. Write the summary of dark reaction by an equation.

Ans : COMP 2009



Ans :

SQP 2015

Light reaction	Dark reaction
Light reaction occurs in the thylakoids/grana of the chloroplast.	Dark reaction occurs in the stroma of the chloroplast.

273. Light reaction and Dark reaction.

Ans :

MAIN 2011

	Light reaction	Dark reaction
(a)	It takes place in the presence of light.	It does not require light.
(b)	It occurs in the grana of chloroplast.	It occurs in the stroma of chloroplast.
(c)	Its products are ATP and NADPH.	Its products are organic compounds.

274. Autotrophs and Heterotrophs.

Ans :

COMP 2017

	Autotrophs	Heterotrophs
(a)	They can prepare their own food.	They cannot prepare their own food.
(b)	They contain chlorophyll.	They do not contain chlorophyll.

275. Stroma and Grana.

Ans :

MAIN 2011

	Stroma of Chloroplast	Grana of Chloroplast
(a)	It is the site of dark reaction.	It is the site of light reaction.
(b)	It is a non-green granular matrix.	It is green flattened sac-like structure.

276. Chloroplast and Chlorophyll.

Ans :

SQP 2001

	Chloroplast	Chlorophyll
(a)	It is an organelle of the cell.	It is the green pigment in chloroplast.
(b)	It is living.	It is non-living.

TWO MARKS QUESTIONS

277. Enumerate the steps involved in testing a green leaf for the presence of starch.

Ans :

MAIN 2005

Step I – Dip the leaf in boiling water for a minute to kill the cells.

Step II – Boil the leaf in methylated spirit to remove chlorophyll.

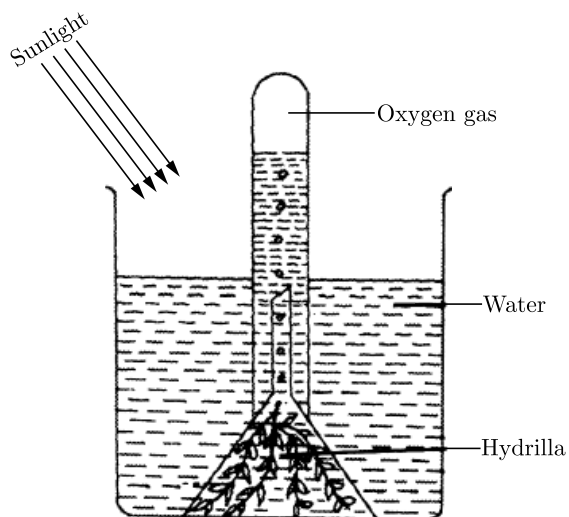
Step III – Put the leaf in normal water to make it soft.

Step IV – Put iodine solution. It turns starch blue black.

278. Draw a neat labelled diagram of the experimental set up to show that green plants give out oxygen during photosynthesis.

Ans :

SQP 2001, 1997

**279.** Explain the following terms :

- Photolysis
- Photolysis in photosynthesis
- Destarched plant

Ans :

MAIN 2010, 2009, 2006

- Photolysis : The splitting of water molecules into hydrogen ions and hydroxyl ions with the help of light energy.
- Photolysis in photosynthesis : The splitting of water molecules into hydrogen ions and hydroxyl ions with the help of light energy.
- Destarched plant is a plant kept in the darkness for 24 – 72 hours, to make it starch

Ans :

SQP 2017

Green plants manufacture food during the process of photosynthesis and give out oxygen which is a life supporting gas for all organisms. Therefore, green plants are essential for life.

233. ATP is needed for dark reaction.

Ans :

MAIN 2001

ATP provides energy for dark reaction. The energy is required to make glucose that is formed through a series of reactions in Calvin cycle.

234. Respiration is said to be the reversal of photosynthesis.

Ans :

COMP 2019

Respiration is a catabolic process while photosynthesis is an anabolic process. During respiration, O_2 is taken in and CO_2 is given out while during photosynthesis CO_2 is taken in and O_2 is given out.

235. Dark reaction is called biosynthetic phase.

Ans :

SQP 2003

Light is not required in dark reaction but occurs simultaneously with light reaction. In this glucose is produced by a number of steps using certain enzymes. So, dark reaction is called biosynthetic phase.

236. Stroma

Ans :

MAIN 2010

The ground matter present in the chloroplast is the stroma. Thylakoids are arranged in the stroma.

237. Autotrophs

Ans :

SQP 2022

The dark reaction of photosynthesis take place in it.

238. Food chain

Ans :

COMP 2015

The inter-dependence of food by various organisms, or the energy flow from one organism to another is called food chain.

For example: Grass $\rightarrow$ Insect $\rightarrow$ Frog $\rightarrow$ Snake $\rightarrow$ Peacock.

All food chains start with green plants.

239. Photophosphorylation

Ans :

MAIN 2009

It means conversion of ATP from ADP and inorganic phosphate in the presence of light. All food chains start with green plants.

240. Heterotrophs

Ans :

COMP 2006

The organisms which depend on autotrophs for their food are heterotrophs. They do not have chlorophyll. e.g. Man.

DIRECTION : State the function of the following:

241. Stomata

Ans :

SQP 2001

Exchange of gases, transpiration

242. Light energy

Ans :

MAIN 2007

To split water molecule into H^+ and $(OH)^-$ ions.

243. Potassium hydroxide

Ans :

SQP 2000

To absorb CO_2 .

244. Chlorophyll

Ans :

COMP 2004

To absorb sunlight.

245. Thylakoid

Ans :

COMP 2013

Site of photosynthesis.

DIRECTION : Choose the correct options from the brackets and complete.

246. During photosynthesis, solar energy is converted into _____. [Heat, Chemical, Mechanical, Electrical]

Ans :

SQP 2000

chemical energy.

247. Function of light energy in photosynthesis. [Splitting of water molecule into H^+ and OH^- , reduce CO_2 , activate chlorophyll, formation of glucose molecules]

Ans :

SQP 2007

To activate chlorophyll

- 215.** State the internal factors which affect photosynthesis.

Ans : MAIN 2001

Chlorophyll content, anatomy of the leaf, accumulation of end products and internal CO_2 concentration, etc.

- 216.** What is the by-product of photosynthesis ?

Ans : SQP 2018

Oxygen.

- 217.** What are the raw materials required for photosynthesis ?

Ans : COMP 2013

Carbon dioxide and water.

- 218.** What are the by-products of photosynthesis ?

Ans : MAIN 2010

Water and oxygen.

- 219.** What happens when chlorophyll gets excited in the presence of light ?

Ans : COMP 2000

The electrons are raised to a higher energy level.

- 220.** What is the advantage of destarching a plant before the start of the photosynthetic experiment?

Ans : MAIN 2005

Destarching ensures that no starch is present in the plant before the start of the experiment.

- 221.** How do you destarch a plant ?

Ans : SQP 2003

By keeping the plant in dark for 48 to 72 hours.

- 222.** Which gaseous element forms the bulk of dry weight of plants ?

Ans : COMP 2009

Carbon

- 223.** In which part of the visible light, the transpiration rate is the highest.

Ans : MAIN 2004

In red light.

- 224.** Other name for light and dark reaction.

Ans : SQP 2017

Hill reaction. (light reaction). Calvin cycle (dark

reaction).

- 225.** Oxygen is a waste product of photosynthesis. Justify.

Ans : MAIN 2011

Oxygen is not a waste material, though it is a by-product of photosynthesis. All organisms use oxygen that is given out by green plants for respiration.

- 226.** What is meant by scotoactive stomata? Give an example.

Ans : COMP 2020

Stomata of some plants closes during daytime but opens at night, are called scotoactive stomata, e.g. allium, cabbage, opuntia.

- 227.** What is meant by compensation point?

Ans : SQP 2017

When the rate of photosynthesis is equal during dawn and dusk, it is termed as compensation point.

DIRECTION : Explain briefly:

- 228.** The term destarched plant.

Ans : MAIN 2002

Destarched plant lacks starch. Destarching is done by keeping the plant in dark for 2-3 days.

- 229.** The term photolysis in photosynthesis.

Ans : SQP 2014

Photolysis is the splitting of water molecules into hydrogen ions and hydroxyl ions in grana in the presence of chlorophyll and light.

- 230.** Chlorophyll is necessary for photosynthesis.

Ans : COMP 2018

The chlorophyll traps solar energy and converts it into chemical energy.

- 231.** Light reaction is called photochemical phase.

Ans : MAIN 2005

In light reaction, light initiates a series of chemical reaction, which occurs in the thylakoids of chloroplast.

- 232.** All life on earth would come to an end if there were no green plants.

DIRECTION : Mention any two differences between each of the following :

264. Autotrophs and heterotrophs

Ans :

SQP 2006

	Autotrophs	Heterotrophs
(a)	Produce their own food.	Cannot prepare their own food.
(b)	Contain chlorophyll.	Do not contain chlorophyll.

265. Chloroplast and chlorophyll

Ans :

COMP 2010

	Chloroplast	Chlorophyll
(a)	An organelle of a cell.	Green pigment in chloroplast.
(b)	Living.	Non-living.

266. Stroma and grana

Ans :

MAIN 2003

	Stroma	Grana
(a)	Site of dark reaction.	Site of light reaction.
(b)	Non green granular matrix.	Green flattened sac like structure.

267. Light reaction and dark reaction

Ans :

SQP 2015

	Light reaction	Dark reaction
(a)	Takes place in the presence of light.	It does not require light
(b)	It occurs in grana of chloroplast.	It occurs in stroma of chloroplast.

268. Match the items given in column I with those in column II.

	Column I		Column II
(i)	Oxygen and water	(a)	Stimulated by light
(ii)	Glucose (sugar)	(b)	machinery
(iii)	Chloroplast	(c)	raw materials
(iv)	Sunlight	(d)	by-products

(v)	CO ₂ and water	(e)	workrooms
(vi)	Cells in the leaf	(f)	end product
(vii)	Grana	(g)	power.

Ans :

SQP 2017

(i) – (d), (ii) – (f), (iii) – (b),
(iv) – (g), (v) – (c), (vi) – (e), (vii) – (a).

269. Without changing the first term rearrange the remaining terms in logical sequence. Destarched plant, iodine added, washed in water, a leaf boiled in alcohol, placed in sunlight (testing the presence of starch).

Ans :

MAIN 2021

Destarched plant → placed in sunlight → a leaf boiled in alcohol → washed in water → iodine added.

270. Given below are certain biological statements which are incomplete and hence incorrect. Rewrite the correct form of the statement by inserting a suitable word/words at the right place. Do not delete any word already given in the statement. Underline the inserted word/words.

- (a) Destarching a plant means removing the starch from the plant.
(b) The splitting of water molecules into hydrogen ions and hydroxyl ions is termed photolysis.

Ans :

SQP 2012

- (a) Destarching a plant means removing the starch from the leaves of the plant.
(b) The splitting of water molecules in the presence of sunlight in grana of the chloroplast into hydrogen ions and hydroxyl ions is termed as photolysis.

DIRECTION : Distinguish between the following pairs:

271. Tonoplast and plasma membrane (Location).

Ans :

MAIN 2008

Tonoplast	Plasma membrane
Surrounds the vacuole.	Surrounds the cell (Both in animal and plant cell)

272. Light reaction and Dark reaction. (site of occurrence)

185. Define photophosphorylation.

Ans :

MAIN 2002

Conversion of low grade energy ADP into high potential chemical energy ATP.

186. What is meant by photolysis of water ?

Ans :

COMP 1997

Splitting of water into hydrogen and hydroxyl ion in presence of sunlight.

187. Write the full form of NADP and ATP.

Ans :

MAIN 2004, 2002

NADP- Nicotinamide adenine dinucleotide phosphate.

ATP - Adenosine tri phosphate.

188. Expand the abbreviation NADP.

Ans :

SQP 2013

Nicotinamide Adenine Dinucleotide Phosphate

189. State the exact location of the Chloroplast.

Ans :

MAIN 2013

Mesophyll cells/Palisade and Spongy cells of leaves.

190. Photolysis and Photophosphorylation.

Ans :

COMP 2005

The difference between Photolysis and Photophosphorylation are as follows :

Photolysis	Photophosphorylation
Splitting of water molecules into H^+ and OH^+ ions with the help of light energy.	Production of ATP molecule from ADP by adding one phosphate group iP (inorganic phosphate) with the help of energy that comes from light.

191. Briefly explain the term photophosphorylation.

Ans :

MAIN 2016

Photophosphorylation is the synthesis of ATP from ADP and phosphate that occurs in a plant using radiant energy absorbed during photosynthesis.

192. Differentiate between the following pair on the basis of what is mentioned in bracket :

NADP and ATP [Expand the abbreviation]

Ans :

SQP 2017

NADP : Nicotinamide Adenine Dinucleotide Phosphate

ATP : Adenosine triphosphate

193. Differentiate between the following pairs on the basis of what is indicated in the brackets.

(i) Leaf and Liver [form in which glucose is stored]

(ii) ATP and AIDS [expand the abbreviations]

Ans :

MAIN 2018

(i) Leaf – Starch

Liver – Glycogen

(ii) ATP – Adenosine triphosphate

AIDS – Acquired Immuno Deficiency Syndrome

194. Why is sleeping under a tree at night not advisable?

Ans :

COMP 2022

At night, the atmosphere surrounding the tree is rich in CO_2 which is harmful, since photosynthesis does not take place at night and only respiration occurs. So, sleeping under a tree at night is not advisable.

195. Expand the following biological abbreviation : ATP

Ans :

MAIN 2019

Adenosine triphosphate

196. Mention the exact location of the following : Thylakoids

Ans :

SQP 2019, 2015

In the stroma (matrix) of chloroplast

197. Mention any three adaptations found in plants to favour the process of photosynthesis.

Ans :

COMP 2011

(a) Large surface area of the leaves.

(b) Presence of more stomata.

(c) The thinness of leaves.

198. State the conditions needed for photosynthesis.

Ans :

MAIN 2006

The conditions needed for photosynthesis are:

(a) Presence of sunlight.

(b) Concentration of carbon dioxide.

(c) Temperature.

(d) Water content.

free as during this period whole of the starch present in the leaves will be used. It ensures any starch present after the experiment has been formed under experimental conditions.

- 280.** Mention any three adaptations found in plants to favour the process of photosynthesis.

Ans :

MAIN 2009

Three adaptations found in plants to favour the process of photosynthesis are :

- (1) Large surface area of the leaves.
- (2) Leaf arrangement (maximum surface area exposed to light).
- (3) Numerous stomata on the leaves.

- 281.** Mention any three points in which respiration is exactly opposite of photosynthesis.

Ans :

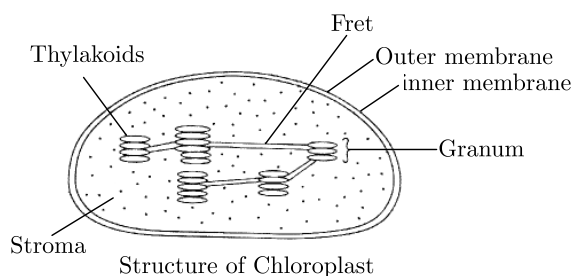
SQP 1995

	Respiration	Photosynthesis
(i)	It is catabolic process in which food substances are broken down.	It is an anabolic process in which food substances are synthesized.
(ii)	It uses oxygen to oxidize the food substances and releases carbon dioxide and energy.	It uses carbon dioxide and water to synthesize the food and releases oxygen.
(iii)	It occurs at all times of day and night.	It occurs only in the day in presence of light.

- 282.** Draw a simplified diagram of a chloroplast.

Ans :

MAIN 2002



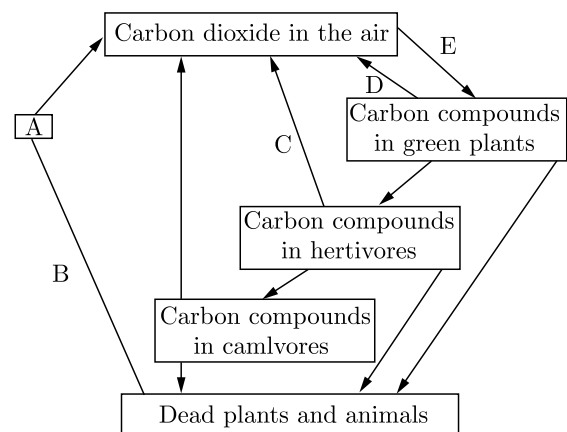
- 283.** Distinguish between Light and Dark reaction.

Ans :

SQP 2017

	Light Reaction		Dark Reaction
(i)	It takes place in the presence of light.	(i)	It does not require light.
(ii)	It occurs in the grana of chloroplast.	(ii)	It occurs in the stroma of chloroplast.
(iii)	Its products are ATP and NADPH.	(iii)	Its products are organic compounds.

- 284.** The diagram shows how carbon compounds are recycled.



- (i) Name the processes shown by the arrows B, C, D and E.
- (ii) Name a type of organism you expect to be named in box A.

Ans :

SQP 2003

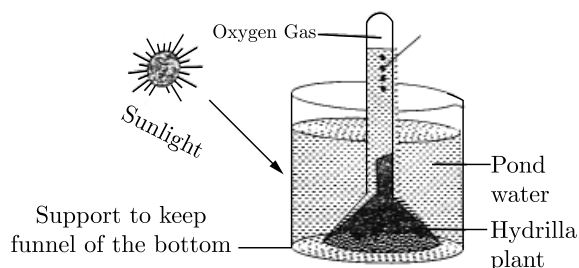
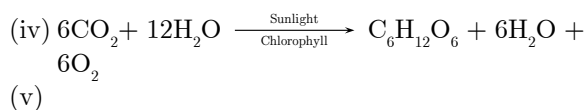
- (i) B is a decay; C is respiration; D is respiration and E is photosynthesis.
- (ii) Bacteria/fungi

- 285.** Distinguish between Producers and Consumers.

Ans :

COMP 2022

	Producers		Consumers
(i)	They are called as autotrophs.	(i)	They are called as heterotrophs.
(ii)	They can make their own food.	(ii)	They cannot make their own food.
(iii)	The cells contain chlorophyll.	(iii)	Chlorophyll is absent in cells.



295. A candidate in order to study the importance of certain factors in photosynthesis, took a potted plant and kept in the dark for over 24 hours. Then in the early hours of the morning she covered one of the leaves with black paper in the centre only. She placed the potted plant in the sunlight for a few hours and then tested the leaf which was covered with black paper for starch.

- What aspect of photosynthesis was being investigated ?
- Is there any control in this experiment ? If so state the same.
- Why was the plant kept in the dark before the experiment ?
- Describe step by step how the candidate proceeded to test the leaf for the presence of starch.

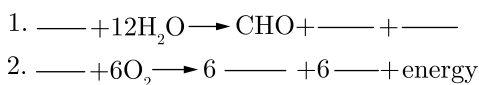
Ans :

SQP 1999

- To show that sunlight is needed for photosynthesis.
- Yes, the uncovered portion of the experimental leaf is the control.
- To destarch the leaf.
- Boil the leaf in alcohol to remove chlorophyll.
 - Wash the leaf in water to make it soft.
 - Add iodine solution on the leaf.

The portion uncovered shows blue-black colour and the portion covered shows brown colour. This indicates that sunlight is needed for photosynthesis.

296. (i) Fill in the blanks in the following equations of two chemical reactions :



- Name the two processes represented by the above two reactions.

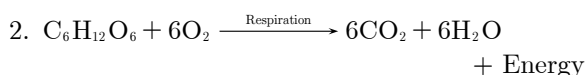
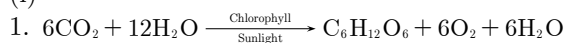
(iii) State any two differences in these processes other than those already indicated in the reactions.

(iv) Which one of these two reactions is the support of all life on earth ?

Ans :

COMP 1994

(i)



(ii) Photosynthesis and respiration.

(iii)

	Respiration	Photosynthesis
1.	Occurs in all the living cells.	Occurs in chlorophyllous cells only.
2.	It takes place at all times without interruption.	It takes place in the presence of light only.

(iv) Photosynthesis.

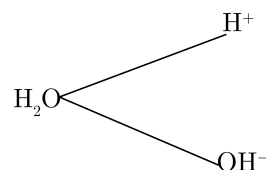
297. Answer the following :

- Name the two phases of photosynthesis.
- What is the role of light in this process ?
- Describe any three adaptations in a green leaf for photosynthesis.
- Describe an experiment to show that light is necessary for photosynthesis.
- Sleeping under a tree at night is not advisable.

Ans :

SQP 2010

- Light reaction (Photolysis of water).
 - Dark reaction (CO_2 reduction).
- Light has energy giving photons which activate and ionise chlorophyll to release electrons. The electrons (split) ionise water molecules. The process is called photolysis.



The H^+ reduces CO_2 to form carbohydrates.

- Large surface area : The surface area of the leaves is very large for the absorption of maximum light energy from the sunlight.
 - Leaf arrangement : The leaves are arranged on the stem in such a way so

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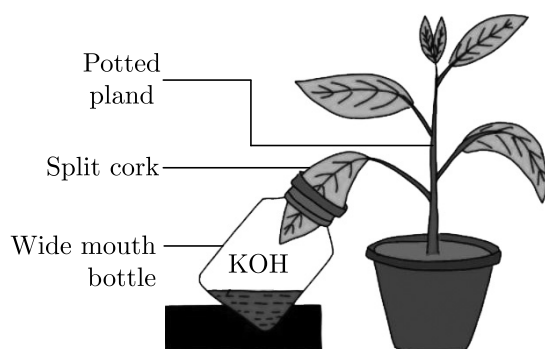
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of CO_2 by green plants during photosynthesis. During respiration, all organism take oxygen and Photosynthesis give out CO_2 into the atmosphere. During combustion of wood or coal, CO_2 is given out. This circulation of carbon through autotrophs, animals and combustion is called carbon cycle.

FIVE MARKS QUESTIONS

- 292.** Study the diagram given below and fill in the blanks with suitable words:



In order to prove that carbon dioxide is necessary for (i) a potted plant is placed in dark for 48 hours to (ii) the leaves. A part of a leaf is inserted into a conical flask containing potassium hydroxide solution. This is to absorb (iii) from the flask. The plant is then placed in sunlight for a few hours. The experimental leaf is tested for starch. The part of the leaf that was inside the conical flask turns (iv) whereas the part of the leaf outside turns (v) in colour.

Ans :

MAIN 2024

- (i) Photosynthesis
- (ii) Destarch
- (iii) Carbon dioxide
- (iv) Brown
- (v) Blue-black

- 293.** A healthy Croton plant bearing variegated leaves was kept in a dark cupboard to destarch it, after which it was placed in sunlight for few hours. One of the leaves was then plucked and an outline of the leaf marking the green and non-green regions was drawn. The leaf was then tested for starch. Using the above information, answer the following questions :

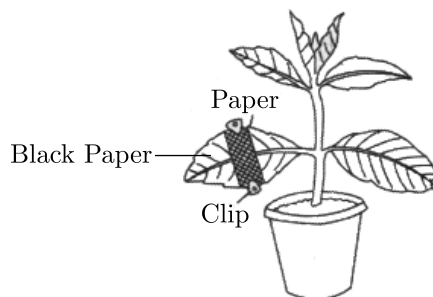
- (i) State the aim of the above experiment.
- (ii) Name the chemical used for testing the presence of starch.
- (iii) Why is the leaf boiled in water and alcohol before testing for the presence of starch ?
- (iv) What change is seen on the leaf after the starch test?
- (v) Give the chemical equation to represent the process of starch formation in plants.

Ans :

SQP 2003

- (i) To prove that chlorophyll is necessary for photosynthesis.
- (ii) Iodine solution.
- (iii) Boiling kills cells and alcohol is a solvent for chlorophyll.
- (iv) The green parts turn blue black while non-green parts turn brown.
- (v) $6\text{CO}_2 + 12\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} + 6\text{O}_2$
 $n(\text{C}_6\text{H}_{12}\text{O}_6) \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_n + n\text{H}_2\text{O}$

- 294.** The diagram given below represents an experiment to prove the importance of a factor in photosynthesis. Answer the questions that follow :



- (i) Name the factor studied in this experiment.
- (ii) What will you observe in the experimental leaf after the starch test ?
- (iii) Explain the process of photosynthesis.
- (iv) Give a balanced chemical equation to represent the process of photosynthesis.
- (v) Draw a neat, labelled diagram of an experimental setup to show that oxygen is released during photosynthesis.

Ans :

MAIN 2019

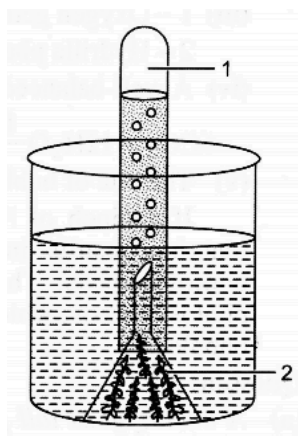
- (i) Sunlight
- (ii) The exposed parts will turn blue-black with iodine solution while the part covered with black paper strip turns brown.
- (iii) The process by which green plants containing chlorophyll produce food (glucose) from carbon dioxide and water by using light energy.

(iv) Test tube B has more bubbles of oxygen because the snail releases CO_2 during respiration due to which CO_2 level increases in the test tube hence the rate of photosynthesis also increases and more oxygen bubbles come out.

(v) An example of a water plant that can be used in this experiment is Hydrilla.



305. The following diagram demonstrates a physiological process taking place in green plants. The whole set up was placed in bright sunlight for several hours. Study the diagram and answer the questions that follow :



- What aspect of the physiological process is being examined ?
- Explain the physiological process mentioned in (i) above.
- Label the parts numbered 1 and 2 in the diagram.
- Write a well-balanced chemical equation for the physiological process explained in (ii) above.
- What would happen to the rate of bubbling of the gas if a pinch of sodium bicarbonate is added to the water in the beaker? Explain your answer.

Ans :

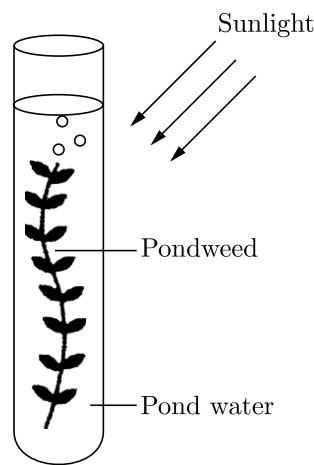
SQP 2016

- Oxygen is evolved during photosynthesis.
- Photosynthesis is a physiological process during which green plants synthesize complex organic compounds (Glucose) from simple inorganic compounds- CO_2 and H_2O in the presence of sunlight and chlorophyll.
- 1-Oxygen, 2- Green aquatic plant
- $6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Chlorophyll}]{\text{Light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} + 6\text{O}_2$

(v) Rate of bubbling will increase by the addition of a pinch of sodium bicarbonate.

306. Pondweed was placed in a test tube containing pond water and exposed to bright sunlight. Bubbles were seen coming up in the water after some time.

- Name the gas evolved.
- What is the source of the gas ?
- For each of the following parts give your answer in terms of bubble count. What would happen if:



- Pond water is replaced by distilled water.
- The apparatus is kept in dark.
- The apparatus is placed in green light.
- A pinch of sodium bicarbonate is added to water in the test tube.
- Crushed ice is added to the water in the test tube.

Ans :

MAIN 2000

- Oxygen
- Oxygen is given out due to photolysis of water
- (a) Bubble count decreases.
(b) Bubble count decreases to almost negligible.
(c) Bubble count decreases (photosynthesis is minimum in green light and maximum in red light).
(d) Bubble count increases (as sodium bicarbonate gives out carbon dioxide).
(e) Bubble count decreases (photosynthesis rate decreases with decrease in temperature).

307. The diagrams given below represent the relationship between a mouse and a physiological process that occurs in green plants. Study the diagrams and answer the questions that follow:

that maximum surface area of leaves is exposed to sunlight.

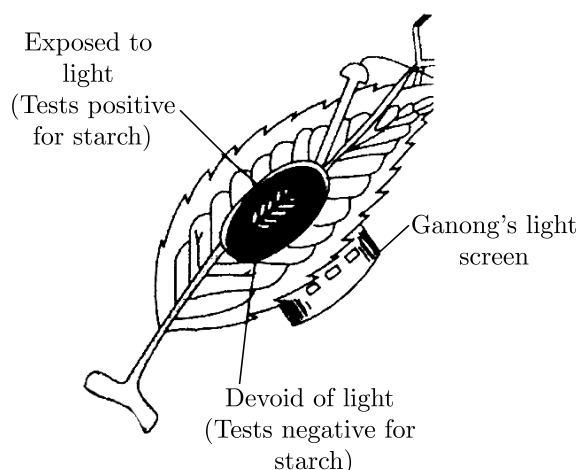
3. **Chloroplasts :** Chloroplasts containing chlorophyll are concentrated in the upper layers of the leaf. It helps in trapping maximum radiant energy from the sunlight quickly.

(iv) **Aim :** To demonstrate that light is necessary for photosynthesis.

Requirements : A destarched potted plant, Ganong's light screen.

Procedure :

1. Take Ganong's light screen.
2. Fix the Ganong's light screen to one of the leaves of the potted plant (destarched) as shown in Figure.
3. Keep the plant with fixed light screen in light at least for 6 hours.
4. Perform the starch test.



Observations : It is observed that the middle portion of screen which allows the light to fall on leaf gives positive starch test and the portion covered with light screen gives negative starch test.

Inference : Light is necessary for photosynthesis.

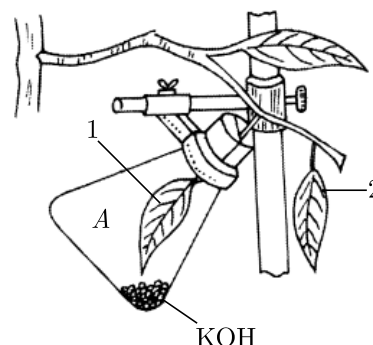
- (v) Sleeping under a tree at night is not advisable because there is no photosynthesis in darkness. Rather plants release large amount of CO_2 due to respiration.

298. The figure given below represents an experiment to demonstrate a particular aspect of photosynthesis. The alphabet 'A' represents a certain condition inside the flask.

- (i) What is the aim of the experiment?
- (ii) Identify the special condition inside the flask.

(iii) Name an alternative chemical that can be used instead of KOH.

(iv) In what manner do the leaves 1 and 2 differ at the end of the starch test?



Ans :

MAIN 2013

- (i) To show that CO_2 is needed for photosynthesis.
- (ii) There is no CO_2 inside the flask.
- (iii) Soda lime.
- (iv) Leaf 1 does not contain starch so it won't change into blue-black colour. Leaf 2 shows colour change (blue-black) as starch is present in it.

299. A potted destarched plant was taken in order to prove that light is necessary for photosynthesis.

- (i) What is meant by destarched plant ? How can it be destarched ?
- (ii) Using the destarched plant describe step by step how you would proceed to prove that in the absence of light the leaf cannot manufacture starch.

Ans :

SQL 1996

- (i) A destarched plant has no starch in the leaves and the leaf remains yellowish brown when the leaf is tested for starch with iodine solution.

A plant can be destarched when it is kept in the darkroom for about 24 hours. The plant, thus, by keeping in darkroom can be made starch-free.

- (ii) A destarched plant from a darkroom is taken and its leaf is covered with black paper on both the sides by means of Mohr's clip. The potted plant is now brought out in the sunlight. The plant is kept here for about 7 to 8 hours in the sunlight. The leaf is now detached and the black papers are removed away. Now, the leaf is boiled in water for about 5 to 6 minutes. Then, it is boiled in

286. Distinguish between Respiration and Photosynthesis.

Ans :

MAIN 2017

	Respiration		Photosynthesis
(i)	O ₂ is used up.	(i)	O ₂ is given out.
(ii)	Glucose is broken down.	(ii)	Glucose is formed.
(iii)	Chlorophyll is not required.	(iii)	Chlorophyll is required.

287. Give scientific reasons:

- It is not possible to demonstrate respiration in green plants in daytime.
- Some leaves have shiny and green upper surface.
- Chloroplasts are called as energy converters.

Ans :

SQP 2006

- During day time, green plants use up CO₂ released during respiration for photosynthesis, it is not possible to measure the CO₂ release and take in.
- Upper surface contain more waxy cuticle and more chloroplasts are present on this surface to absorb light energy.
- Chloroplasts contain the green pigment chlorophyll which trap sunlight for photosynthesis and convert it into chemical energy.

288. (a) Give the overall chemical equation of photosynthesis in green plants.
(b) Mention two significant advantages of photosynthesis to the living world.

Ans :

MAIN 2011

- $$6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} + 6\text{O}_2 \uparrow$$
- Two significant advantages of photosynthesis to the living world are as follow :
 - Photosynthesis causes the production of food. The various types of organic food which animals need as food comes from plants.
 - Plants use carbon dioxide (liberated during respiration) and liberate life-supporting oxygen, which is used for respiration.

289. Write in steps the light phase of photosynthesis.

Ans :

SQP 2017

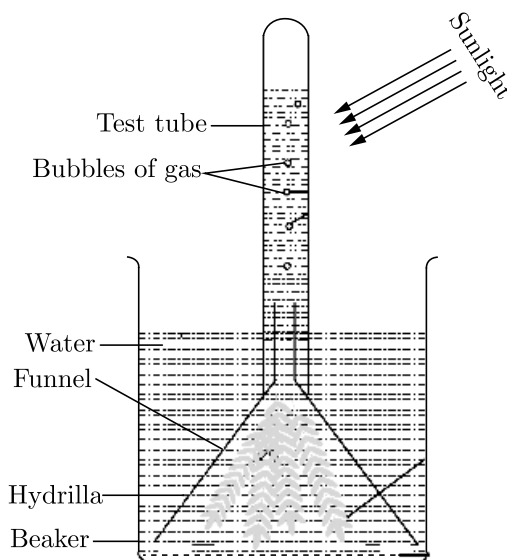
- Light phase or photochemical phase takes place in granum of chloroplast wherein chlorophyll molecules are present which get excited in the presence of light by absorbing photons.
- The absorbed energy splits water molecules into hydrogen ion and hydroxyl ion.
- The hydrogen ions are then accepted by NADP to form NADPH.
- The hydroxyl ions react with each other to form oxygen which is given out as molecular oxygen.
- The energy contained within the excited electrons of chlorophyll molecules are utilized in converting ADP into energy rich ATP.

290. Write an experiment to prove that O₂ is given out during photosynthesis.

Ans :

COMP 2019

To show that O₂ is released during photosynthesis. Take a beaker containing pond water. Keep some Hydrilla plants in a funnel in the beaker. Insert a test-tube full Bubbles of gas of water. Make sure that the level of water in the beaker is above the level of the stem of the funnel. Keep the apparatus in the sun for a few hours. Bubbles of gas will collect in the test tube. Test the gas by a glowing splinter, it will bursts into flame. This shows that the oxygen is evolved during photosynthesis.

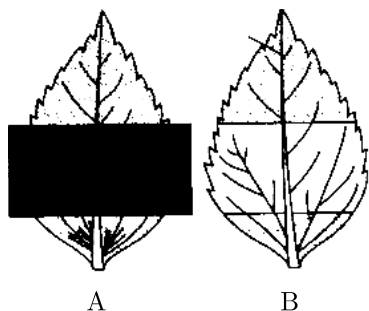


291. Explain carbon cycle.

Ans :

MAIN 2009

All organic compounds contain carbon. Carbon is absorbed from the atmosphere in the form



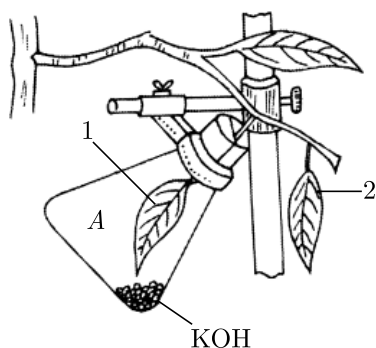
Ans :

COMP 2015

- (i) Aim – To show that starch is formed in photosynthesis.
- (ii) 1. To a healthy green leaf cover a portion of it on both sides with black paper fixed in position with two paper clips either in the morning before the sun rises or the previous evening, so that the experiment is done with a starch-free leaf.
2. Expose the plant to sunlight for about 6-8 hours.
3. Collect the leaf and decolourise it with alcohol.
4. Dip it into iodine solution.
5. Note that the exposed portions turn blue-black showing the presence of starch, while the screened portion (Portion under the black paper) turns yellowish brown, there being no starch formed in it.
- (iii) Conclusion – It proves that light is necessary for the manufacture of starch.

303. The figure given below represents an experiment to demonstrate a particular aspect of photosynthesis. The alphabet 'A' represents a certain condition inside the flask.

- (i) What is the aim of the experiment ?



- (ii) Identify the special condition inside the flask.
- (iii) Name an alternative chemical that can be used instead of KOH.
- (iv) In what manner do the leaves 1 and 2 differ

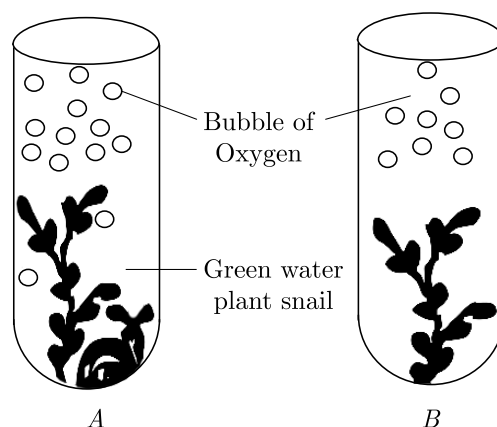
at the end of the starch test ?

Ans :

SQP 2021

- (i) Carbon dioxide is necessary for photosynthesis.
- (ii) KOH absorbs all CO_2 from the flask and the leaf gets no CO_2 for photosynthesis.
- (iii) NaOH (Sodium hydroxide).
- (iv) Leaf 1 will not turn blue black with iodine solution (negative starch test) while. Leaf 2 will turn blue black when tested with iodine solution (positive starch test).

304. The diagram below shows two test-tubes A and B. Test-tube A contains a green water plant. Test-tube B contains both a green water plant and a snail. Both test-tubes are kept in sunlight. Answer the questions that follow :



- (i) Name the physiological process that releases the bubbles of oxygen.
- (ii) Explain the physiological process as mentioned above in (i).
- (iii) What is the purpose of keeping a snail in test-tube 'B'?
- (iv) Why does test-tube 'B' have more bubbles of oxygen?
- (v) Give an example of a water plant that can be used in the above experiment.
- (vi) Write the overall chemical equation for the above process.

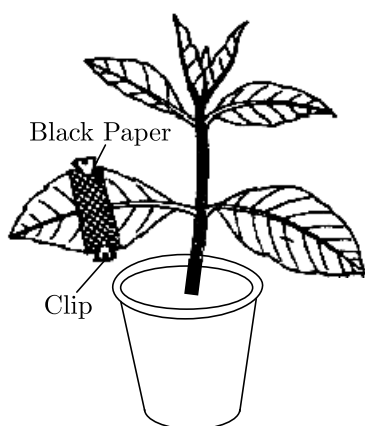
Ans :

MAIN 2017

- (i) The physiological process is Photosynthesis.
- (ii) The physiological process by which green plants in the presence of sunlight and chlorophyll prepare food in the form of glucose (carbohydrate) using carbon dioxide and water.
- (iii) The snail respire and releases CO_2 which acts as a source of CO_2 . The plant uses it in the process of photosynthesis.

alcohol so that the green colouring matter of the leaf called chlorophyll dissolves in alcohol. The leaf is then washed under the tap and tested with iodine for starch. The region or the part of the leaf that was covered with black paper turns yellowish-brown. It shows that no starch was manufactured while the rest of the part of the leaf turns blue-black. It proves or demonstrates that starch was made in the leaf in the presence of sunlight.

- 300.** The given diagram represents an experiment conducted to prove the importance of a factor in Photosynthesis. Study the same and then answer the questions that follow :



- (i) Name the factor being studied in this experiment.
- (ii) Why was the plant kept in a darkroom before conducting the experiment ?
- (iii) Why was the experimental leaf then kept in :
 - (1) boiling water
 - (2) methylated spirit ?
- (iv) Name the solution used to test for the presence of starch in the leaf.
- (v) What will we observe in the experimental leaf at the end of the starch test ?
- (vi) Give a balanced chemical equation to represent the process of photosynthesis.

Ans :

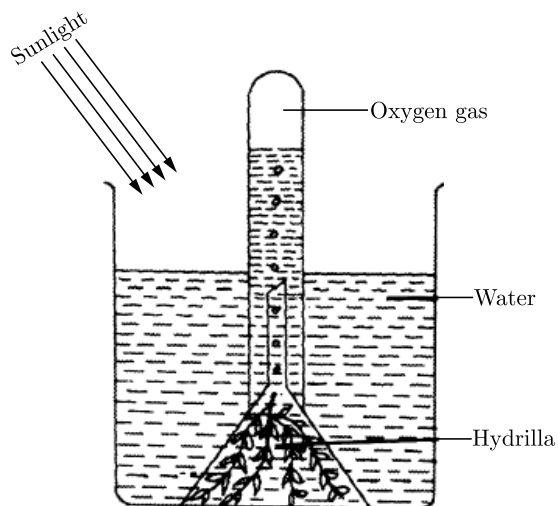
SQP 2009

- (i) Light is necessary for photosynthesis.
- (ii) The plant was kept in the darkroom before conducting the experiment in order to destarch it so that to ensure that no starch is present in the leaves before the experiment.
- (iii) (1) To destroy all enzymes in the leaf cell so that no further chemical changes take place. Moreover, to make the leaf cells permeable to iodine solution.

- (2) To remove all chlorophyll from the leaf cells and make it colourless.

- (iv) Iodine solution
- (v) The part of the leaf which is covered with black paper will not turn blue black with iodine solution since it did not receive sunlight so it could not manufacture starch.
- (vi) $6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$

- 301.** The figure represents an experiment set up to study a physiological process in plants :



- (i) Name the physiological process being studied.
- (ii) Explain the process.
- (iii) What is the aim of the experiment ?
- (iv) Give a well balanced equation to represent the process.

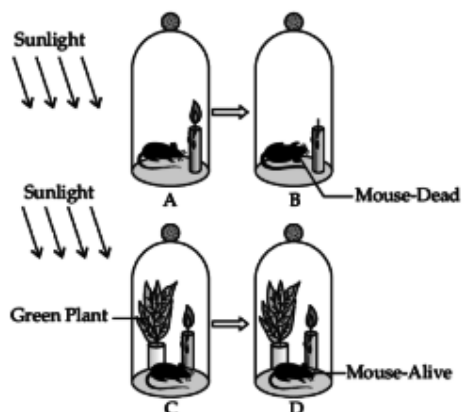
Ans :

MAIN 2001

- (i) Photosynthesis.
- (ii) During daytime, when the sunlight falls on green tissues say leaf, the sunlight is trapped by the chlorophyll specially of the palisade cells, is utilized in chemical processes of manufacturing food, from raw materials such as CO_2 and H_2O .
- (iii) Oxygen is produced during photosynthesis.
- (iv) $6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} + 6\text{O}_2$

- 302.** The figure given here is for performing an experiment on photosynthesis. Answer the following :

- (i) What is the aim of this experiment ?
- (ii) Describe an experiment to show that light is necessary for photosynthesis.
- (iii) you conclude from this experiment?



- Name the physiological process occurring in the green plant that has kept the mouse alive.
- Explain the physiological process mentioned above.
- Why did the mouse die in bell jar B?
- What is the significance of the process as stated in (i) for life on earth?
- Represent the above mentioned physiological process in the form of a chemical equation.

Ans :

MAIN 2003

- Photosynthesis.
- Photosynthesis is the process by which green plants in the presence of sunlight and chlorophyll prepare food in the form of carbohydrates using carbon dioxide and water.
- Mouse died in bell jar B because the source of oxygen i.e., the green plant was missing and the oxygen present in the bell jar was utilized in burning of candle.
- Photosynthesis provides food and balances the oxygen and carbon cycle in the atmosphere.
- $$6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$$

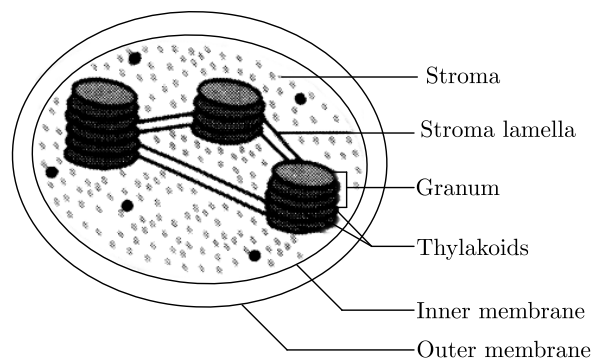
- 308.** (i) Draw a neat and well-labelled diagram of the chloroplast.
- (ii) List the events taking place in the photochemical phase of photosynthesis.
- (iii) If you are planning an experiment to show the effect of light on photosynthesis:
- Will you select white light or green light? Justify your answer.
 - Why would you select a destarched plant?

Ans :

SQP 2001

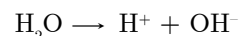
- (i)

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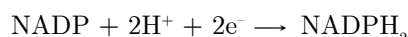


- (ii) During photochemical reaction, the following processes take place:

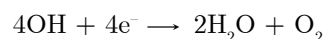
- Photolysis of water, splitting of water molecules into hydrogen and hydroxyl ions.



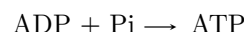
- Production of NADPH₂



- Formation of molecular oxygen



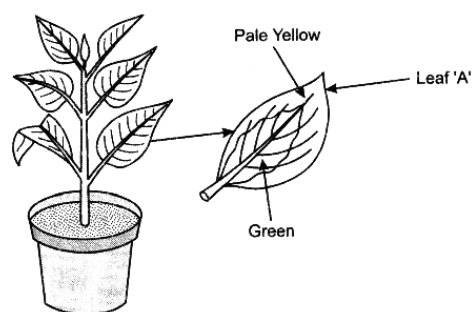
- Photophosphorylation



- (iii) (a) White light It has all the wavelength of visible light.

- (b) Destarched plant is used as control plant.

- 309.** A potted plant with variegated leaves was taken in order to prove a factor necessary for photosynthesis. The potted plant was kept in the dark for 24 hours and then placed in bright sunlight for a few hours. Observe the diagrams and answer the questions.



- What aspect of photosynthesis is being tested in the above diagram?
- Represent the process of photosynthesis in the form of a balanced equation.
- Why was the plant kept in the dark before beginning the experiment?
- What will be the result of the starch test

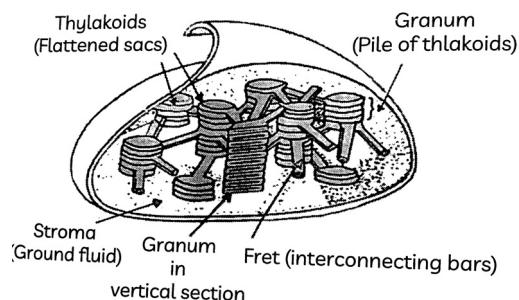
performed on leaf 'A' shown in the diagram?
Give an example of a plant with variegated leaves.

(v) Draw a neat labelled diagram of a chloroplast.

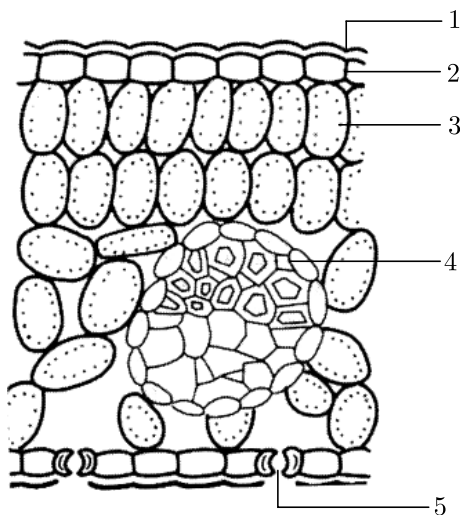
Ans :

SQP 2017

- (i) Chlorophyll is necessary for photosynthesis.
 (ii) $6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} + 6\text{O}_2$
 (iii) To destarch the leaves.
 (iv) The green part of the leaf turns blue black and the pale yellow part will turn brown with iodine solution at the end of starch test.
 Example: Coleus/Geranium/Croton/Tradescantia
 (v)



310. The figure represents the vertical section of a leaf:



- (i) Name the parts 1 to 5.
 (ii) How many veins have been shown in the section?
 (iii) State the functions of part 4 and 5.

Ans :

COMP 2012

- (i) 1 – Cuticle, 2 – Upper epidermis, 3 – Palisade tissue/Chloroplast, 4 – Xylem, 5 – Stoma

(ii) One vein has been shown.

(iii) Xylem – helps in the conduction of water.

Stoma – through which exchange of gases takes place (CO_2 and O_2).

CASE BASED QUESTION

311. In a biology experiment, students observed how sunlight is converted into chemical energy in green plants. They learned that this process occurs in specific parts of the cell, with most photosynthesis taking place in the oceans.

1. What process converts sunlight into chemical energy in plants?
2. Where in the plant cell does the light reaction occur?
3. What is the role of chloroplasts in photosynthesis?
4. How many chloroplasts are typically found in a leaf cell?

Ans :

1. The process that converts sunlight into chemical energy in plants is photosynthesis.
2. The light reaction of photosynthesis occurs in the grana of the chloroplasts.
3. Chloroplasts are responsible for capturing sunlight and facilitating the conversion of light energy into chemical energy.
4. There are typically 40 to 50 chloroplasts present in each leaf cell.

312. Students in a biology class learned that pigments like chlorophyll and carotenoids are involved in photosynthesis. They also discovered that light, carbon dioxide, water, and chlorophyll are essential for the process to occur.

1. What are the two major groups of pigments involved in photosynthesis?
2. Why do carotenoids become visible before leaf fall?
3. What are the essential requirements for photosynthesis?
4. What is the role of chlorophyll in photosynthesis?

Ans :

1. The two major groups of pigments involved in photosynthesis are chlorophylls and carotenoids.

- Carotenoids become visible before leaf fall because chlorophylls break down first.
- The essential requirements for photosynthesis are light, chlorophyll, carbon dioxide, and water.
- Chlorophyll's role is to capture sunlight and convert it into chemical energy.

313. Students learned that photosynthesis has two phases: the light reaction, which produces ATP and NADPH, and the dark reaction, where carbon dioxide is fixed to form glucose. They also found that glucose is converted into starch.

- What are the two phases of photosynthesis?
- Where does the light reaction occur, and what are its end products?
- What is the role of RuBP in the dark reaction?
- How is glucose converted into starch after its production?

Ans :

- The two phases of photosynthesis are the light reaction and the dark reaction.
- The light reaction occurs in the thylakoids of the chloroplast, and its end products are ATP and NADPH.
- RuBP (Ribulose biphosphate) is the primary acceptor of carbon dioxide in the dark reaction.
- Glucose produced during photosynthesis is converted into starch by the process of polymerization.

314. Students learned about photorespiration, photosynthesis, and performed experiments using Ganong's light screen and iodine solution to demonstrate the importance of light in photosynthesis.

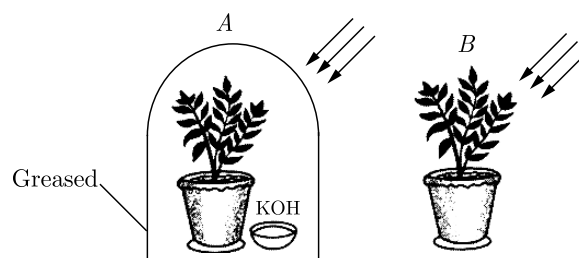
- What is the process of photorespiration?
- How does Ganong's light screen help demonstrate that light is necessary for photosynthesis?
- What are the three main uses of carbohydrates formed during photosynthesis?
- How is starch detected in leaves during experiments on photosynthesis?

Ans :

- Photorespiration is the uptake of oxygen and release of carbon dioxide in light by photosynthesizing tissue.
- It blocks light in parts of the leaf to show that photosynthesis only occurs where light is available.

- Carbohydrates are used for respiration, food storage, and growth.
- Starch is detected by turning blue-black in the presence of iodine solution.

315. In a biology experiment, Two healthy green plants were placed in the dark for 24 hours. They were then set up as shown in the figure and left for four hours. Then a leaf was taken from each plant and the chlorophyll was removed from the leaves.



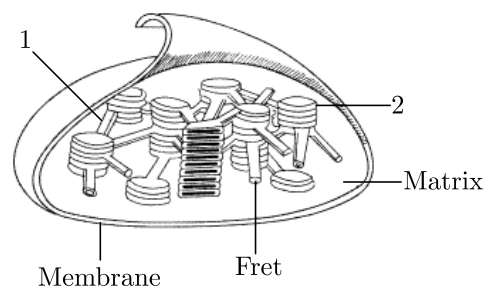
- How is chlorophyll removed ?
- What is the next and final step in this experiment?
- What would be the result of the final step ?
- Why is it necessary to grease the glass sheet ?
- What hypothesis is being tested in this experiment?

Ans :

MAIN 2005

- The chlorophyll is removed by boiling the leaf in alcohol or ether.
- The leaf is then treated with iodine solution.
- The leaf from plant A would not show starch test while the leaf from plant B would become blue black showing the presence of starch.
- It is necessary to grease the glass sheet to prevent the entry of air containing carbon dioxide.
- The hypothesis that carbon dioxide is necessary for photosynthesis is being tested in this experiment.

316. A diagrammatic representation of the internal structure of an organelle found in a plant cell is shown. Study the same and then answer the questions that follow :



3. Which of the following shows thigmonastic response ?

(a) Insectivorous plants
(b) Sun flower
(c) Lotus
(d) Bryophyllum

Ans :

SQP 2013

In conclusion, insectivorous plants, such as the Venus flytrap, pitcher plants, sundews, and bladderworts, exhibit thigmonastic responses as part of their predatory behavior.

Thus (a) is correct option.

4. Growth of pollen tube towards the ovule is an example of _____ .

(a) phototropism
(b) geotropism
(c) hydrotropism
(d) chemotropism

Ans :

MAIN 2005

Thus (c) is correct option.

5. The hormone that promotes ripening of fruits is _____ .

(a) cytokinin
(b) ethylene
(c) gibberellin
(d) auxin

Ans :

COMP 2002

Ethylene is a gaseous plant hormone that causes the ripening of fruits. It is synthesized in a large amount in the fruits and tissues undergoing ripening and senescence, respectively. Ethylene is commonly used in agricultural practice.

Thus (b) is correct option.

6. What are Plant hormones called ?

(a) Hypohormones
(b) Phytohormones
(c) Metahormones
(d) Cytohormones

Ans :

SQP 2006

Thus (b) is correct option.

7. Auxins were discovered by:

(a) Darwin
(b) F.W.Went
(c) Boysen - Jensen
(d) None of these

Ans :

SQP 2010

In 1928, Dutch botanist Fritz W. Went finally isolated auxin diffused out from the tip of oat coleoptiles in the gelatin block.

Thus (b) is correct option.

8. A higher concentration of ethylene is found in :

(a) Ripe banana
(b) Green banana
(c) Fresh potato tuber
(d) Green apple

Ans :

MAIN 2004

Because ethylene is Gaseous in state which helps banana to ripen faster that is main work of this hormone is to support the ripening of fruits.

Thus (a) is correct option.

9. In tropic movements, plant parts move

(a) away from the stimulus
(b) either towards or away from the stimulus
(c) only towards water
(d) towards the stimulus

Ans :

SQP 2020

There are exceptions though as in Nastic movement where the tropism exhibited is independent of the direction of the stimulus.

Thus (d) is correct option.

10. Auxins are abundantly produced in :

(a) meristematic region of the shoot
(b) base of the root
(c) base of the shoot
(d) shoot

Ans :

COMP 2000

Auxins are produced abundantly in the meristematic region of the shoot.

Thus (a) is correct option.

11. Which one of the following plant hormones is responsible for phototropism in plants?

(a) Cytokinin
(b) Auxin
(c) Ethylene
(d) Gibberellins

Ans :

MAIN 2004

The hormones responsible for phototropism are auxins. Bending of the plant is caused by more elongation of the shaded part as compared to the lighter side, caused by increased auxin concentration on shaded side and decreased on the other side.

Thus (b) is correct option.

CHAPTER 6

CHEMICAL COORDINATION IN PLANTS

SUMMARY

Growth is one of the most fundamental characteristics of all living organisms. In plants, growth takes place by cell division and cell enlargement. The main areas of growth by cell division in plants is meristems which occur just behind shoot and root tips.

In plants, movement are seen in the form of bending, twisting and elongation of certain parts. They do not need a fast response to small changes in their immediate environment. They do need to respond to light, gravity and seasonal changes. They also need to coordinate growth of cells in various parts of the plant body. Nervous system or sense organs are not present in plants but their sensitivity and coordination is the result of chemical control exercised by plant hormones.

Plants respond to stimuli by producing hormones, similar to hormones of animals. The main way in which plants respond to these hormones is by growth. With the help of hormones, growth is stimulated or inhibited in plants.

1. PLANT GROWTH REGULATORS

It is an established fact that plants produce some specific chemical substances, which are capable of moving from one organ to the other, so as to produce their effect on growth. These substances, which are active in very small amounts are called plant hormones (or Phytohormones).

The term phytohormone (phyton = plant) was coined to distinguish them from animal hormones.

The term hormone was given by William Bayliss and Ernest Starling.

1.1 Classification of Hormones

Hormones are divided into five major classes, namely: (1) Auxins, (2) Gibberellins, (3) Cytokinins, (4) Absciscic acid and (5) Ethylene.

These five hormones are divided into two groups: (a) The growth promoters : Auxins, Gibberellins,

Cytokinins.

(b) The growth inhibitors : Absciscic acid and Ethylene.

2. DISCOVERY OF PLANT GROWTH REGULATORS (PLANT HORMONES)

The first indication of its existence was given by Darwin (1880), who was studying the bending of the coleoptile of a Canary grass towards light. He found that light falling on the tip of grass coleoptile causes some influence. This influence (hormone) is transmitted downward and causes the coleoptile to bend towards light. He also demonstrated that when the coleoptile tip was removed it did not bend when exposed to light. The phototropic response did not occur.

2.1 Functions of Plant Hormones (Phytohormones)

The various functions are as follows :

1. Flowering of plants
2. Ripening of fruits
3. Germination of seeds
4. Breaking dormancy of seeds
5. Stomatal movement in leaves
6. Phototropism, geotropism, chemotropism, hydrotropism, thigmotropism and nastic movements.

3. PHYSIOLOGICAL EFFECTS OF PLANT GROWTH REGULATORS (PLANT HORMONES)

3.1 Auxins

Auxins (Gk. Auxein : to grow) are the first group of plant hormones which are produced from the root and shoot-tips of the plant body, from where they migrate to the region of their action.

They were first discovered by F. W. Went (1928) while experimenting on oat plant (*Avena sativa*). Auxins are of following two types:

- (A) Natural auxins are Indole acetic acid (IAA) and Indole butyric acid (IBA).
- (B) Synthetic auxins are 2, 4 - dichlorophenoxy acetic acid (2, 4 -D) and Naphthalene acetic acid (NAA).

Phototropism is a response to the stimulus of light. It can either be towards the source of light (positive phototropism) or away from it (negative phototropism).

Thus (a) is correct option.

20. The hormone that promotes ripening of fruits is _____.

- (a) ethylene
- (b) gibberellin
- (c) cytokinin
- (d) auxin

Ans :

COMP 2002

Ethylene is a gaseous plant hormone that causes fruit to mature. It is abundantly synthesised in the fruits and tissues undergoing ripening and senescence, respectively. Ethylene promotes the ripening of fruits such as tomatoes, lemons, and oranges.

Thus (a) is correct option.

21. Auxin inhibits the growth of
- (a) apical buds
 - (b) root on stem cuttings
 - (c) lateral axillary buds
 - (d) parthenocarpic development of fruits

Ans :

SQP 2008

Auxin inhibits the growth of lateral axillary buds. Thus (c) is correct option.

22. Common gibberellin is _____.
- (a) GA_1
 - (b) GA_2
 - (c) GA_7
 - (d) GA_3

Ans :

SQP 2003

Gibberellic acid is a plant hormone that stimulates plant growth and development. GA_3 is the most common gibberellin because it is the main component in Gibberella culture and it is the most frequently produced GA .

Thus (d) is correct option.

23. Leaf fall occurs when the amount of _____.
- (a) auxin increases
 - (b) cytokinin decreases
 - (c) gibberellin decreases
 - (d) abscisic acid increases

Ans :

MAIN 2010

Leaf fall occurs in a tree when there is increase in concentration of DAbscisic acid.

Thus (d) is correct option.

24. Apical dominance phenomenon is caused by :
- (a) ABA
 - (b) GA
 - (c) cytokinins
 - (d) auxins

Ans :

COMP 2017

Apical dominance in plants refers to the condition where the apical bud is prominent hence keeping the central stem dominant. It doesn't allow the proliferation of lateral buds. It is caused due to production of auxin in the apical bud. This results in prevention of growth of lateral buds in plants. Thus (d) is correct option.

25. A plant's response to light is known as
- (a) phototropism
 - (b) hydrotropism
 - (c) photonasty
 - (d) geotropism

Ans :

MAIN 2000

The movement of a plant part in response to light is called phototropism.

Thus (a) is correct option.

26. A plant hormone related with inhibition of senescence is :
- (a) Ethylene
 - (b) GA
 - (c) Bromic acid
 - (d) ABA

Ans :

COMP 2020

Plant senescence refers to ageing in plants. The hormone which is responsible for the inhibition of senescence is GA .

Thus (d) is correct option.

27. Leaf fall occurs when the amount of _____.
- (a) auxin increases
 - (b) cytokinin decreases
 - (c) abscisic acid increases
 - (d) gibberellin decreases

Ans :

SQP 2018

Leaf abscission is a detachment or fall of older leaves. It occurs at the base of the petiole. It is observed that the intact leaf does not fall off because base of petiole of young leaf synthesizes auxin. During leaf fall, auxin content is low in the lamina as compared to stem. Also, ethylene content is high in the lamina during abscission. Thus (c) is correct option.

28. A plant hormone responsible for inducing morphogenesis during plant tissue culture is
- (a) ethylene
 - (b) gibberellin
 - (c) cytokinin
 - (d) abscisic acid

2. It increases resistance in plants to cold.
3. In plants subjected to salinity or under severe drought, abscisic acid reduces the rate of transpiration by temporarily closing the stoma.
4. It induces bud dormancy in many plants.
5. In Ivy and bean, it promotes rooting of stem cuttings.
6. It inhibits seed germination, stimulates closure of stomata and helps seeds to withstand desiccation.

4. MOVEMENT IN PLANTS

Plants show movement in response to certain stimuli like - light, water, gravity, wind and touch. Some of the plant movements that is usually observed are as follows:

Opening and closing of stoma, flower closing during night, sunflower turns toward the sun, movement of insectivorous plants and movement of roots in the soil. These movements can be divided into two categories:

- (A) Tropic movements (Tropism)
- (B) Nastic movements [Not in Syllabus]

4.1 Tropic movements (Tropism)

A tropism is the movement of part of a plant either towards the source of stimulus (Positive) or away from it (Negative). Depending upon the nature of stimuli these movements are of following five types:

1. **Phototropism** : The movement of plant parts in response to light is called phototropism. Most of the stems and flower stalks move towards light (positively phototropic). Roots move away from light (negatively phototropic). The leaves keep their faces at right angles to the direction of light (transversely phototropic).
2. **Geotropism** : The movement of plant parts in response to the force of gravity is called Geotropism. The primary root always grows vertically towards downward direction towards the force of gravity (positively geotropic). Shoot moves just opposite to the force of gravity (negatively geotropic).
The secondary roots and branches place themselves at right angles to the force of gravity and are called diageotropic. Examples are Rhizome and stolon.
3. **Hydrotropism** : The movement of plant parts in response to the water is called Hydrotropism. Roots are positively hydrotropic as they bend towards the source of water. Shoots are

negatively hydrotropic as it grows away from the source of water.

4. **Thigmotropism** : Growth movements made by plants in response to contact (touch) with a solid object are called thigmotropism. These are curvature movements and are most apparently seen in tendrils and twiners. Plants such as bitter melon, bottle melon, grapevine and passion flower have stem tendrils which are positively thigmotropic. Plants such as peas and glory lily have leaf tendrils which are positively thigmotropic.
5. **Chemotropism** : The tropic movement in response to the stimulus of the chemicals are called Chemotropic movements. Growth of pollen tube through the style towards the embryo sac, movement of pollen tube towards ovary due to absorption of calcium and borate from style of carpel, movement of tentacles in *Drosera*, an insectivorous plant, closing of lid of *Nepenthes*, an insectivorous plant, due to nitrogenous food, movement of fungal hyphae towards sugars and peptides and penetration of haustoria of parasite into host body all are examples of chemotropism.

MULTIPLE CHOICE QUESTION

1. A sunflower plant bends towards the sun. It is _____ response.
(a) Thigmonastic
(b) Photonastic
(c) Thermonastic
(d) Seismonastic

Ans :

MAIN 2017

One of the best characterized growth responses in plants is phototropism.
Thus (b) is correct option.

2. Which of the following is a plant hormone?
(a) Thyroxine (b) Insulin
(c) Oestrogen (d) Cytokinin

Ans :

SQP 2010

Cytokinin is a plant hormone. Insulin is an animal hormone. Oestrogen is an animal hormone. Cytokinins promote cell division, and are present in greater concentration in areas of rapid cell division, such as in fruits and seeds.
Thus (d) is correct option.

- (i) Identify the organelle.
- (ii) Name the physiological process occurring in this organelle.
- (iii) Mention one way in which this process is beneficial to man.
- (iv) Name the phases of the process occurring in the parts labelled '1' and '2'.
- (v) A chemical substance 'NADP' plays an active part in one of the phases. Give the expanded form of NADP and state its role in the above process.
- (vi) Represent the physiological process mentioned in (ii) above in the form of a chemical equation.

Ans :

SQP 2019

- (i) The given organelle is chloroplast.
- (ii) Photosynthesis.
- (iii) Oxygen is released during photosynthesis which is required for breathing by man.
- (iv) (1) Dark Reaction.
(2) Light Reaction.
- (v) NADP-Nicotinamide Adenine Dinucleotide Phosphate. It acts as a hydrogen carrier.
- (vi) $6\text{CO}_2 + 12\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$

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12. The plant hormone used to speed up the malting process in brewing industry is
 (a) ethylene (b) GA_3
 (c) auxin (d) cytokinin

Ans :

SQP 2009

Gibberellins are used to speed up the malting process in brewing industry. They increase the yield of malt from barley grains.

Thus (b) is correct option.

13. During his biology class, Anil was learning about different hormones in plants and animals. He wanted to identify which of the following is specifically a plant hormone. Which of the following is a plant hormone?

- (a) Adrenaline
 (b) Glucagon
 (c) Cytokinin
 (d) Oxytocin

Ans :

MAIN 2019

Cytokinin is a plant hormone. Insulin is an animal hormone. Oestrogen is an animal hormone. Cytokinins promote cell division, and are present in greater concentration in areas of rapid cell division, such as in fruits and seeds.

Thus (c) is correct option.

14. Stems are :
 (a) positively geotropic and negatively phototropic
 (b) positively geotropic and positively phototropic
 (c) negatively phototropic and negatively geotropic
 (d) negatively geotropic and positively phototropic

Ans :

SQP 2022

Stems grow away from the roots and exhibits tropic movement in the direction where there is sunlight.

Thus (d) is correct option.

15. The climbing organs of plants like tendrils grow towards any support which they come in contact of and wind around them for support. This is an example of
 (a) chemotropism
 (b) nastic movements
 (c) geotropism
 (d) thigmotropism

Ans :

COMP 2017

The growth of climbing organs like tendrils

towards any support they come in contact with, and winding around them for support, is an example of thigmotropism. Thigmotropism is the movement or growth of a plant in response to touch or physical contact with a solid object. This response helps climbing plants to anchor themselves and grow upward by wrapping around structures for support.

Thus (d) is correct option.

16. Which of the following hormones regulate stomatal closure :

- (a) auxins (b) ABA
 (c) GA (d) cytokinin

Ans :

SQP 2016

In guard cells, the plant hormone abscisic acid (ABA) inhibits stomatal opening and induces stomatal closure through the coordinated regulation of ion transport.

Thus (b) is correct option.

17. Both ethylene and ABA are responsible for
 (a) inducing dormancy of seeds
 (b) stimulation of apical dominance
 (c) ripening of fruits
 (d) promoting abscission of leaves and fruits

Ans :

MAIN 2004

Ethylene and ABA hormones accelerate the process of senescence.

Thus (d) is correct option.

18. When roots of a plant always move towards water, even if it means going against the pull of gravity This indicates
 (a) hydrotropism
 (b) negative geotropism
 (c) geotropism
 (d) positive geotropism

Ans :

SQP 2023

Hydrotropism modifies root growth to respond to a water potential gradient in soil and grow towards areas with a higher moisture content.

Thus (a) is correct option.

19. The growth of plants in the direction of light is called _____.
 (a) phototropism
 (b) geotropism
 (c) chemotropism
 (d) hydrotropism

Ans :

MAIN 2009

Physiological Effects on Plants :

1. Auxins promote cell elongation and growth of stems and roots. It also promotes enlargement of many fruits by stimulating elongation of cells in all directions.
2. In many plants, the apical bud grows and lower axillary buds are suppressed. Removal of apical buds results in the growth of lower buds. The auxin of the terminal buds inhibits the growth of lateral buds. This phenomenon is called Apical dominance.
3. Weeds are unwanted plants growing in a field along with a crop that do not allow proper growth of the crop. By spraying auxin they can be destroyed and removed.
4. If the lower cut ends of rose and Bougainvillea are dipped in auxins, very soon large number of roots are developed on the cut ends due to which these cuttings develop into successful plants.
5. In apples, tomatoes and bananas auxins can induce fruit formation without fertilization which is called Parthenogenesis .
6. In pineapple, auxin promotes flowering.
7. In lettuce, auxins help in delaying the flowering.
8. In cotton plants, auxin increases the cotton seed production.

3.2 Gibberellins

Gibberellins were first reported in Japan by E Kurosawa (1926). Unlike auxins, they enhance longitudinal growth of stem when applied to the plants.

Physiological Effects on Plants :

1. Gibberellins promote seed germination in cereals and lettuce.
2. In pea, bean, tomato and cabbage on treatment with gibberellins they develop broader and elongated leaves.
3. They are more potent parthenocarpic agents than auxins.
4. Gibberellins causes stem elongation and leaf expansion but have no effect on roots.
5. In cabbage, internodes are reduced. Just prior to flowering internode elongates enormously. This is called Bolting. By application of gibberellins bolting can be induced artificially.
6. They are used to increase fruit size and bunch in grapes.
7. Gibberellins break dormancy of buds and tubers.

3.3 Cytokinins

Cytokinins are the hormones which promote cytokinesis in cells of various plant origins and prevent ageing in tissues. They have little or no effect on growth.

Physiological Effects on Plants :

Physiological effects on plants are as follows :

1. In the presence of auxin, cytokinins stimulate cell division.
2. Cytokinins delay ageing process in plant organs by controlling protein synthesis.
3. Cytokinins break the dormancy of many seeds and promote their germination.
4. These help in the translocation of solutes in phloem.
5. Cytokinins provide resistance to plants injured by high or low temperatures.
6. In seeds, they cause expansion of cotyledons.
7. They inhibit apical dominance.
8. They help in promotion of chlorophyll synthesis in chloroplasts and organ formation.

3.4 Ethylene

Ethylene is a simple gaseous hormone which stimulates transverse growth. It is produced in higher plants and fungi. Most widely used plant growth hormone in agriculture.

Physiological Effects on Plants :

The Physiological effects on plants are as follows :

1. Ethylene retards flowering in most plants but induces flowering in pineapple and mango.
2. In banana, apple, mango and citrus ethylene stimulates ripening of fruits.
3. Ethylene modifies growth by inhibiting the elongation of stems and roots. In stem, it causes swelling of nodes.
4. Ethylene breaks dormancy of buds and seeds.
5. It initiates germination in peanut seeds, sprouting of potato tuber and induces flowering in mango.

3.5 Absciscic Acid (ABA)

Abscisic acid is a natural growth inhibitor which retards growth. It is found in angiosperms, gymnosperms, pteridophytes and some mosses. Fruits and seeds contain highest amount of ABA. It is also called stress hormone since it increases tolerance of plants to various kinds of stresses.

Physiological Effects on Plants :

The Physiological effects on plants are as follows :

1. Absciscic acid inhibits cell division and cell elongation. Acts as a general plant growth inhibitor.

Ans :

MAIN 2001

Cytokinin is the plant hormone responsible for inducing morphogenesis during plant tissue culture. It promotes cell division and differentiation, leading to the development of shoots and roots from undifferentiated plant tissues. In plant tissue culture, a balance between auxins and cytokinins determines whether root or shoot formation occurs, with cytokinin playing a key role in shoot development.

Thus (c) is correct option.

29. The roots of a plant are

- (a) positively geotropic but negatively phototropic
- (b) positively phototropic but negatively geotropic
- (c) negatively hydrotropic but positively phototropic
- (d) positively phototropic but negatively geotropic

Ans :

SQP 2003

The roots of a plant grow towards gravity, which makes them positively geotropic. They also grow away from light, making them negatively phototropic. This is a characteristic adaptation that allows roots to grow deeper into the soil to access water and nutrients while avoiding exposure to light.

Thus (a) is correct option.

30. A higher concentration of ethylene is found in:

- (a) ripe banana
- (b) green banana
- (c) fresh potato tuber
- (d) green apple

Ans :

MAIN 2014

A higher concentration of ethylene is found in ripe banana because ethylene is a plant hormone that promotes the ripening of fruits. As bananas ripen, they produce more ethylene, which accelerates the ripening process. Ethylene acts as a signaling molecule, triggering the biochemical changes that cause the fruit to soften, change color, and become sweeter. In contrast, green bananas and other unripe fruits have lower levels of ethylene.

Thus (a) is correct option.

31. Growth of pollen tube towards the ovule is an example of _____.

- (a) phototropism
- (b) geotropism
- (c) hydrotropism
- (d) chemotropism

Ans :

COMP 2011

The growth of the pollen tube towards the ovule is an example of chemotropism. This is because the movement is guided by chemical signals released from the ovule, which attract the pollen tube. The pollen tube grows in response to these chemical stimuli, allowing fertilization to occur. Chemotropism specifically refers to growth or movement in response to chemical signals.

Thus (d) is correct option.

32. Rohit wants to measure the growth in length of a plant for his project. The device used for this is:

- (a) Sphygmomanometer
- (b) Manometer
- (c) Auxanometer
- (d) None of these

Ans :

MAIN 2023

Auxanometer is used to measure the growth in length of a plant organ, there are two types of auxanometer. i.e. Arc auxanometer and Pfeffer's auxanometer (automatic auxanometer). Auxanometers can measure plant growth in response to a variety of parameters, including temperature, sunlight and water conditions.

Thus (c) is correct option.

33. Mohit observed that the leaves of a Mimosa plant fold when touched. He wonders what external stimulus causes this reaction. The leaves of Mimosa are sensitive to:

- (a) Heat
- (b) Touch
- (c) Light
- (d) Smell

Ans :

COMP 2015

The leaves of Mimosa have the capability to display thigmonasty (touch-induced movement). In the sensitive plant, the leaves respond to being touched, shaken, heated or rapidly cooled. The speed of the response depends on the magnitude of the stimulus.

Thus (a) is correct option.

34. Rina is studying plant hormones and is curious about which one promotes plant growth. She learned that certain hormones either inhibit or promote growth. The hormone that functions as a growth promoter is:

- (a) Abscissic acid
- (b) Ethylene
- (c) Auxin
- (d) Both b and c

Ans :

COMP 2017

Plant growth promoter hormones are those plant

hormones that help in the growth of plants.
Example: auxins, gibberellins, etc.

Thus (c) is correct option.

- 35.** Arjun noticed that the mature leaves and fruits of a plant were falling off and wanted to know which hormone was responsible for this process. The plant hormone triggering the fall of mature leaves and fruits from plants is:

(a) auxin
(b) gibberellin
(c) kinetin
(d) abscisic acid

Ans :

COMP 2008

The falling of mature leaves and fruits from plants is called abscission. It is caused by a hormone called abscisic acid. This hormone inhibits a plant's growth by acting against growth-promoting hormones.

Thus (d) is correct option.

- 36.** Priya is conducting an experiment on plant tissue culture. She adjusts the hormone levels and observes how different ratios of auxin to cytokinin affect plant growth. She wonders what a high auxin to cytokinin ratio will favor. A High auxin to cytokinin ratio favours the

(a) shoot development
(b) formation of undifferentiated cells
(c) root development
(d) None of the above

Ans :

MAIN 2001

It is well established that the auxin-cytokinin ratio used in culture media determines the degree of shoot and/or root formation in tissue culture. A high ratio of cytokinin to auxin favours shoot production, whereas a high auxin to cytokinin ratio favours root production.

Thus (c) is correct option.

- 37.** During his plant physiology studies, Arjun learned that certain hormones help plants cope with stress conditions like drought. He is now trying to figure out which one is known as the stress hormone. The stress hormone is

(a) auxin
(b) abscisic acid
(c) ethylene
(d) cytokinin

Ans :

SQP 2003

Abscisic acid (ABA) is often referred to as the stress hormone in plants because it helps the

plant respond to stress conditions like drought, salinity, and cold. It induces the closure of stomata to reduce water loss through transpiration and promotes dormancy in seeds and buds to help the plant survive unfavorable conditions.

Thus (b) is correct option.

- 38.** Reema is studying plant movements and wants to identify which of the following is not an example of tropism. Which of the following are not tropism?

(a) Growth of pollen tube towards sugary substance.
(b) Twining of tendrils around a support in response to touch
(c) Folding up of the leaves of Mimosa pudica when touched.
(d) None of the above

Ans :

SQP 2020

(a) Growth of the pollen tube towards a sugary substance is an example of chemotropism, which is a tropic movement in response to a chemical stimulus.
(b) Twining of tendrils around a support in response to touch is an example of thigmotropism, which is a directional movement towards a physical object.
(c) Folding up of the leaves of Mimosa pudica when touched is an example of nastic movement, not tropism. Nastic movements are responses to stimuli that do not depend on the direction of the stimulus.

Thus (c) is correct option.

- 39.** Ravi noticed that his houseplant was growing toward the window where sunlight was coming in and wondered what this type of growth is called. The growth of plants in the direction of light is called:

(a) phototropism
(b) geotropism
(c) chemotropism
(d) hydrotropism

Ans :

SQP 2002

Phototropism is the growth of plant parts, such as stems or leaves, in response to light. In positive phototropism, the plant grows toward the light source, as seen in most stems and shoots. This helps the plant maximize its ability to perform photosynthesis. Other forms of tropism like geotropism respond to gravity, and chemotropism responds to chemicals.

Thus (a) is correct option.

DIRECTION : Matching Type Question :

40. Riya is trying to match plant hormones with their physiological effects. She tabulated the pairs as follows:

Hormone	Effect on the plant
P	Promotes the germination of seeds in cereals and lettuce
Q	Inhibits seed germination and promotes stomatal closure

Identify the correct pair of hormones.

- (a) P – Gibberellins, Q – Absciscic Acid
 (b) P – Auxins, Q – Ethylene
 (c) P – Cytokinins, Q – Auxins
 (d) P – Ethylene, Q – Gibberellins

Ans :

COMP 2007

Gibberellins promote seed germination, especially in cereals and lettuce, while Absciscic acid (ABA) inhibits seed germination and promotes the closure of stomata during water stress.

Thus (a) is correct option.

41. Priya is matching plant hormones with their effects on the plant. She created the following table:

Hormone	Effect on the plant
P	Promotes apical dominance in plants
Q	Delays the aging of leaves and other organs

Identify the correct pair of hormones.

- (a) P – Auxins, Q – Cytokinins
 (b) P – Ethylene, Q – Gibberellins
 (c) P – Absciscic Acid, Q – Cytokinins
 (d) P – Cytokinins, Q – Auxins

Ans :

MAIN 2002

Auxins promote apical dominance by inhibiting the growth of lateral buds, while cytokinins delay the aging process in plant organs like leaves by promoting cell division and protein synthesis.

Thus (a) is correct option.

42. Rakesh is identifying hormones based on their effects on plants. He has made the following table:

Hormone	Effect on the plant
P	Promotes flowering in pineapple
Q	Induces fruit formation without fertilization in tomatoes

Identify the correct pair of hormones.

- (a) P – Gibberellins, Q – Absciscic Acid
 (b) P – Cytokinins, Q – Auxins
 (c) P – Ethylene, Q – Auxins
 (d) P – Auxins, Q – Gibberellins

Ans :

SQP 2014

Ethylene promotes flowering in pineapple, while auxins can induce parthenogenesis, which is the formation of fruit without fertilization in plants like tomatoes.

Thus (c) is correct option.

43. Nisha made a table to match plant hormones with their roles in plant physiology:

Hormone	Effect on the plant
P	Promotes seed dormancy
Q	Induces bolting in cabbage before flowering

Identify the correct pair of hormones.

- (a) P – Absciscic Acid, Q – Gibberellins
 (b) P – Cytokinins, Q – Auxins
 (c) P – Auxins, Q – Gibberellins
 (d) P – Gibberellins, Q – Cytokinins

Ans :

COMP 2010

Absciscic acid (ABA) is known to promote seed dormancy, while gibberellins induce bolting in cabbage before flowering, leading to rapid stem elongation.

Thus (a) is correct option.

44. Raj is matching hormones with their functions in plants and prepared the following pairs:

Hormone	Effect on the plant
P	Causes swelling of nodes and inhibits stem elongation
Q	Breaks bud dormancy and promotes leaf expansion

Identify the correct pair of hormones.

- (a) P – Gibberellins, Q – Cytokinins
 (b) P – Ethylene, Q – Gibberellins
 (c) P – Cytokinins, Q – Ethylene
 (d) P – Absciscic Acid, Q – Gibberellins

Ans :

MAIN 2006

Ethylene inhibits stem elongation and causes swelling of nodes in plants. Gibberellins break bud dormancy and promote leaf expansion in many plant species.

Thus (b) is correct option.

66. What is Parthenocarpy ? Give one example.

Ans : COMP 2019
Development of fruit without fertilization. e.g.,
Apple, banana, tomato.

DIRECTION : Fill up the blanks with suitable words:

67. Gibberellins are widely used in _____
and _____.

Ans : SQP 2005
Horticulture ; food industries

68. Cytokinins have specific effects on _____.

Ans : COMP 2004
Cell division

69. Roots of cycas plant do not respond to geotropic stimulus. They are called _____.

Ans : MAIN 2010
Ageotropic

70. Plant roots exhibit _____ tropism.

Ans : COMP 2018
Geotropism.

71. _____ plant hormone is a gas.

Ans : SQP 2008
Ethylene

72. _____ hormone stimulate germination of seeds.

Ans : MAIN 2016
Cytokinin

73. The movement of plant parts towards the stimulus of chemical is _____.

Ans : COMP 2023
Chemotropism.

74. The first step in the process of plant growth is _____ germination.

Ans : MAIN 2018
Seed

75. A plant hormone is an _____ substance.

Ans : SQP 2020
Organic

76. Movement of fungal hyphae towards _____ and peptones is called chemotropism.

Ans : COMP 2015
Sugars

_____ are situated below the bark and are responsible for increase in the diameter of the stem.

Ans : MAIN 2011
Lateral meristems

78. The phenomenon of development of seedless fruit without fertilization is called _____.

Ans : SQP 2013
Parthenocarpy

79. A universal flowering hormone still not been isolated by scientists is _____.

Ans : MAIN 2017
Florigen

80. Auxins were isolated initially from the urine of humans who suffered from a disease called _____.

Ans : COMP 2008
Pellagra

TWO MARKS QUESTIONS

81. Which parts of a plant exhibit:

- (a) Negative Geotropism
- (b) Positive Hydrotropism

Ans : SQP 2025
(a) Shoot, (b) Root

82. How does chemical coordination occur in plants ?

Ans : MAIN 2012
Chemical coordination in plants are occurred in plants with the help of fluids secreted in plants known as phytohormones or plant hormones. These hormones regulate the growth of the plants.

83. What is the full form of: IAA, NAA and IBA ?

Ans : COMP 2015
IAA - Indole acetic acid
NAA - Naphthalene acetic acid
IBA - Indole butyric acid

ONE MARK QUESTIONS

DIRECTION : Arrange and rewrite the terms in the group in the correct order so as to be in a logical sequence beginning with the term that is underlined.

50. Apical meristem, Positive phototropism, Auxins, Cell elongation.

Ans : SQP 2025
Auxins, Apical meristem, Cell elongation, Positive phototropism

DIRECTION : Name the following:

51. The tropic movement of plant parts in response to chemicals.

Ans : MAIN 2024
Chemotropism

52. A growth inhibiting hormone in plants.

Ans : MAIN 2019
Absciscic acid

53. The hormone which stimulates cell division.

Ans : COMP 2004
Cytokinin

54. Directional movement of plants towards a stimulus.

Ans : SQP 2006
Tropic movement

55. The hormone located at the apical meristem.

Ans : COMP 2019
Auxin.

DIRECTION : Define the following :

56. Growth

Ans : MAIN 2000
It is a vital process which brings about a permanent change in the weight, size, volume of a plant.

57. Tropic movement

Ans : COMP 2013
The movement of plant parts in the direction of a stimulus such as light, gravity and touch.

58. Thigmotropism

Ans : MAIN 2004
The movement of plant parts in response to touch.

59. Ethylene.

Ans : SQP 2017
Ethylene is a plant regulator that is a gas. It promotes fruits ripening.

DIRECTION : Answer the following.

60. Which hormones inhibit growth?

Ans : COMP 2001
Absciscic acid and ethylene are growth inhibitors.

61. Distinguish between thigmotropism and geotropism.

Ans : MAIN 2009

Thigmotropism	Geotropism
The movement of plant parts in response to touch, e.g. growth of tendrils of pea plant.	The movement of plant parts towards the stimulus of gravity, e.g. growth of roots towards gravity.

62. Mention the physiological effects of gibberellin.

Ans : SQP 2000
Movement of plants towards the stimulus of light.

63. The shoot of a plant usually shows phototropism. Comment.

Ans : MAIN 2010
The movement of plant organs especially the shoot towards the direction of light is called phototropism. Under the influence of light, more amount of auxin is produced to the shaded side of the stem causing a curvature towards the lighted side.

64. Expand the following biological abbreviations :

Ans : MAIN 2019
Adenosine triphosphate

65. State the main functions of the following : Cytokinins

Ans : SQP 2019
Expansion of cotyledons, inhibits apical dominance, cell elongation.

DIRECTION : Conversation Type Question

45. A biology teacher asked her students to name two types of plant movements in response to external stimuli.

Raj said: Phototropism and Geotropism

Sonu said: Hydrotropism and Chemotropism

Lata said: Thigmotropism and Nastic Movements

Abhay said: Phototropism and Hydrotropism

Who were correct?

- (a) Raj and Sonu
- (b) Sonu and Abhay
- (c) Lata and Abhay
- (d) Raj and Lata

Ans :

SQP 2003

Phototropism, geotropism, hydrotropism, chemotropism, and thigmotropism are plant movements in response to different external stimuli. Nastic movements are not included in the syllabus. Sonu and Abhay gave correct examples of plant movements.

Thus (b) is correct option.

46. A biology teacher asked her students to name two natural auxins found in plants.

Raj said: Indole Acetic Acid (IAA) and Indole Butyric Acid (IBA)

Sonu said: 2, 4-D and IAA

Lata said: Naphthalene Acetic Acid (NAA) and IBA

Abhay said: IAA and IBA

Who were correct?

- (a) Raj and Abhay
- (b) Sonu and Lata
- (c) Raj and Lata
- (d) Sonu and Abhay

Ans :

COMP 2011

Indole Acetic Acid (IAA) and Indole Butyric Acid (IBA) are natural auxins found in plants. 2, 4-D and NAA are synthetic auxins. Thus, Raj and Abhay gave correct examples of natural auxins. Thus (a) is correct option.

47. A biology teacher asked students to name two hormones responsible for delaying the aging process in plants.

Raj said: Cytokinins and Gibberellins

Sonu said: Auxins and Cytokinins

Lata said: Ethylene and Absciscic Acid

Abhay said: Cytokinins and Auxins

Who were correct?

- (a) Raj and Sonu
- (b) Sonu and Abhay
- (c) Lata and Raj
- (d) Abhay and Lata

Ans :

MAIN 2006

Cytokinins delay the aging process in plant organs. Auxins also promote growth, and hence, together with cytokinins, they help delay senescence. Ethylene and abscisic acid are growth inhibitors, not involved in delaying aging.

Thus (b) is correct option.

48. A teacher asked her students to name two plant hormones that help in breaking seed dormancy.

Raj said: Absciscic Acid and Ethylene

Sonu said: Gibberellins and Ethylene

Lata said: Auxins and Cytokinins

Abhay said: Gibberellins and Cytokinins

Who were correct?

- (a) Raj and Sonu
- (b) Sonu and Abhay
- (c) Raj and Lata.
- (d) Lata and Abhayl

Ans :

SQP 2000

Gibberellins and ethylene are involved in breaking seed dormancy. Absciscic acid promotes dormancy, while auxins and cytokinins are more involved in growth promotion rather than breaking dormancy. Thus (b) is correct option.

49. A biology teacher asked students to name two phytohormones responsible for inducing fruit ripening.

Raj said: Ethylene and Cytokinins

Sonu said: Ethylene and Gibberellins

Lata said: Ethylene and Auxins

Abhay said: Auxins and Gibberellins

Who were correct?

- (a) Raj and Lata
- (b) Sonu and Raj
- (c) Lata and Sonu
- (d) Abhay and Lata

Ans :

COMP 2009

Ethylene is the main phytohormone responsible for inducing fruit ripening. Gibberellins may have a role in promoting growth, but auxins and cytokinins do not play a direct role in fruit ripening.

Thus (c) is correct option.

84. List any four functions of Phytohormones.

Ans :

SQP 2019

1. Flowering of plants
2. Ripening of fruits
3. Germination of seeds
4. Stomatal movement in leaves.

85. Explain briefly apical dominance. Name the hormone that controls it.

Ans :

MAIN 2023

The apical buds grow and lower axillary buds are suppressed. Removal of apical buds results in growth of lower buds. This is called apical dominance. The hormone is Auxin.

86. What is Bolting ? Give an example.

Ans :

SQP 2010

Just prior to flowering, internode elongates enormously. This is called bolting. e.g., Cabbage.

87. Auxins and Gibberellins induce growth in plants. Which hormone has inhibitory effect on growth ?

Ans :

MAIN 2008

Ethylene has inhibitory effect on elongation of stem and root.

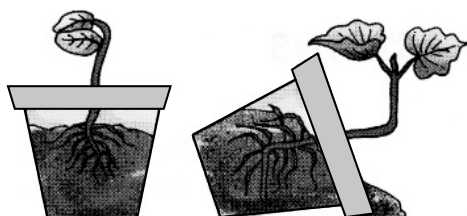
88. Mention any two advantages of senescence.

Ans :

MAIN 2014

1. Old and inefficient organs are replaced by young and developing leaves, buds, flowers and fruits.
2. In trees, when the old leaves are shed , nutrients are withdrawn into main trunk and diverted to the young parts later on.

89. Study the figure and answer the following.



- (i) What is depicted in the figure?
- (ii) Explain the process.

Ans :

SQP 2017

- (i) Geotropism.
- (ii) The movement of roots of the plants towards gravity is called geotropism. This is caused by

the unequal distribution of auxin on the two sides of roots.

90. One rotten orange can spoil the whole basket full of oranges. Give reason.

Ans :

MAIN 2020

The ripening of orange is caused by hormone ethylene. Ethylene is a gas, through diffusion it passes from one orange to another. So it starts spreading from one orange to another and slowly all oranges in basket gets spoilt.

91. Define:

- (i) Phototropism.
- (ii) Hydrotropism.

Ans :

COMP 2023

- (i) The movement of plant organs towards the stimulus of light is photo tropism, e.g. bending of stem towards light.
- (ii) The movement of plant parts towards water, e.g. growth of roots towards water.

92. Sunflower head point towards the sun. Explain.

Ans :

MAIN 2009

In the presence of light, auxin hormone gets concentrated on the shaded part of sunflower stem which causes growth on one side making a curvature of the plant towards the lighted side (sun).

THREE MARKS QUESTIONS

93. State the physiological effects of auxin.

Ans :

MAIN 2016

Auxin hormone is usually seen at the growing region. It promotes stem elongation, phototropism, growth of roots, development of fruits etc.

94. State the effects of cytokinin and auxin.

Ans :

MAIN 2002

Cytokinin stimulates cell division, germination of seeds, promotes root growth. Auxin promotes stem elongation, growth of roots etc.

95. Ali has some pea plants in his garden which need a support to grow as seen in the picture given below:



- (i) Name the phenomenon depicted by the shoot in the given figure.
- (ii) Define the above phenomenon.
- (iii) Write the name of the part marked X.

Ans :

MAIN 2024

- (i) Thigmotropism
- (ii) The movement of plant parts in response to stimuli caused by contact with foreign body is called thigmotropism.
- (iii) Stem tendril

96. Give example of the following:

- (i) Chemotropism
- (ii) Thigmotropism
- (iii) Phototropism

Ans :

COMP 2021

- (i) Growth of pollen tube towards the ovule.
- (ii) Growth of tendril around a support.
- (iii) Growth of stem towards light.

97. Demonstrate an experiment to prove hydrotropism.

Ans :

SQP 2003

Take a conical flask with water. Cover the neck of the flask with a wire mesh. Keep a few germinated bean seeds on it. After a few days it is observed that the primary roots of the seeds grow towards water in the flask and the shoots grow towards light.

98. Though plants do not have a nervous system, yet they perform all physiological activities comment.

Ans :

COMP 2004

It is true that plants do not have a nervous system, yet they perform their various activities by hormones which include both growth promoters and inhibitors.

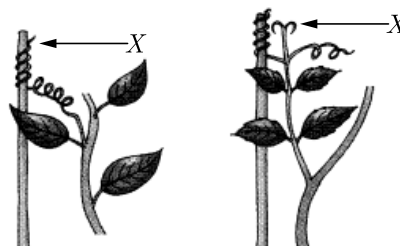
99. Give reason: Stem of a plant grows towards light.

Ans :

COMP 2019

This is due to the synthesis of auxin hormone at the shoot tip. In the presence of light, auxin accumulates on the shaded part of the stem, causing growth on one side, leading to a curvature towards the lighted side.

100. Study the figure and answer the following:



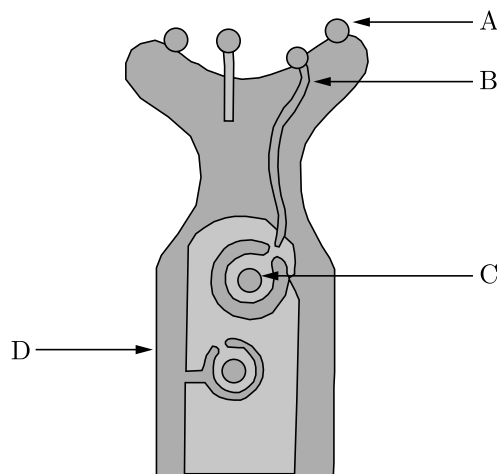
- (i) What is X?
- (ii) Explain the process which is being undertaken.

Ans :

MAIN 2000

- (i) Tendril
- (ii) Thigmotropism: is the movement of tendril towards the stimulus of touch. The tendrils twine around the support due to the accumulation of auxin

101. The figure represents an example of a plant movement. Study it and answer the following:



- (i) What is shown in the figure?
- (ii) Define the process.
- (iii) Mark the parts A, B, C and D.

Ans :

COMP 2006

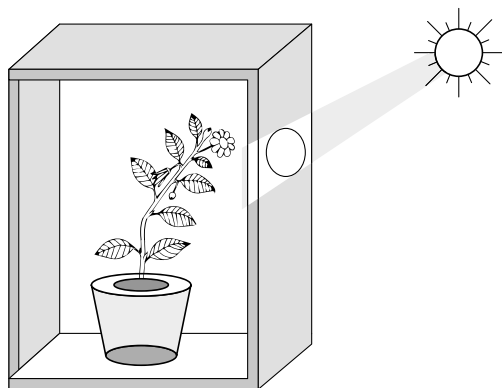
- (i) Chemotropism.
- (ii) The movement of plant organs in response to chemicals. The sugar present in the stigma stimulates the growth of pollen tube through

the style towards the ovule.

- (iii) A – Pollen grain B – Pollen tube
C – Female gamete D – Ovary

102. Study the figure and answer the following.

- (i) What is depicted in the figure?



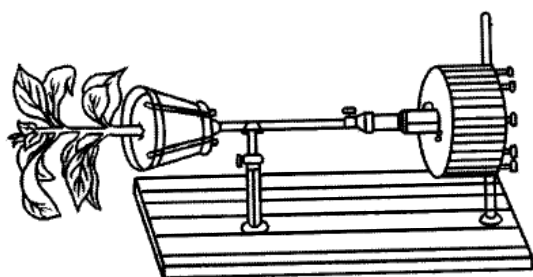
- (ii) Define the process.
(iii) How does the plant move towards the light?

Ans :

SQP 2014

- (i) Phototropism.
(ii) The movement of shoots towards light.
(iii) This is due to the synthesis of auxin hormone at the shoot tip. In the presence of light, auxin accumulates on the shaded part of the stem, causing growth on one side, resulting in a curvature towards the lighted side.

103. The diagram given below is an instrument which is used to eliminate the effect of gravity.



- (i) Name the instrument.
(ii) What is the use of this instrument in this experiment?
(iii) Why does the plant grow straight?

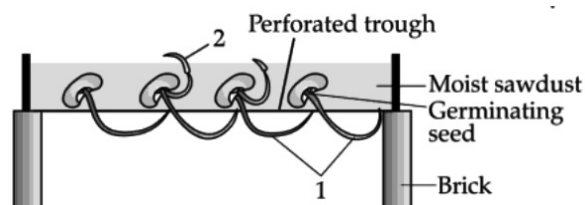
Ans :

MAIN 2015

- (i) Clinostat.
(ii) If it rotates, it neutralises the effect of gravity.
(iii) Due to the equal distribution of auxin, which causes equal growth on all sides, and no curvature takes place.

FIVE MARKS QUESTIONS

104. Given below is an experimental setup to demonstrate a particular tropic movement in germinating seeds. Study the diagram and answer the questions that follow :



- (i) Label the parts 1 and 2.
(ii) Name the tropic movement shown by part 1.
(iii) Part 1 is affected by two stimuli. Name them. Which one of the two is stronger?
(iv) What is Thigmotropism? Give one example.
(v) What is meant by 'Positive' and 'Negative' tropic movements in plants?

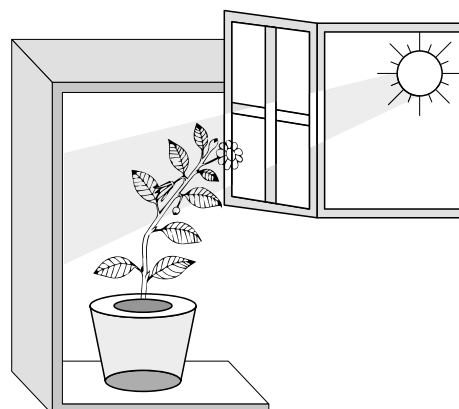
Ans :

COMP 2022

- (i) 1-Radicle 2-Plumule
(ii) Hydrotropism
(iii) Gravity and Water - Water is stronger.
(iv) Growth movement of plants in response to touch stimulus, e.g., Sweet Pea.
(v) Movement of parts of plant towards source of stimulus is positive and away from source of stimulus is negative.

105. The diagram shows some movement in plants.

- (i) What is the aim of the experiment?
(ii) Why does the plant move towards the light source?
(iii) What is geotropism?
(iv) What are tropic movements?
(v) What will happen if the light source is removed from the experiment?



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Ans :

MAIN 2003

- To demonstrate phototropic movement.
- Due to light the auxin gets destroyed and the plant bends towards light.
- The movement of plant parts in response to the force of gravity.
- It is the movement of part of the plant either towards the source of stimulus or away from it.
- The plant will grow straight.

106. Give reasons for the following:

- Exogenous application of auxin fails to enhance growth in an intact plant.
- Gibberellic acid is able to induce reversal of dwarfism in many genetically dwarf plants.
- Rice plants infected by fungus *Gibberella fujikuroi* grow foolishly tall.
- In pineapple, auxin is used.
- Abscisic acid is also called stress hormone.

Ans :

COMP 2018

- Intact plants already have required amount of auxin. Further application of auxin makes no effect.
- In genetically dwarf plants, GA level is low but the external supply of GA to such plants causes rapid elongation in their height.
- The fungus produces a growth hormone called gibberellins which causes abnormal growth of stem and leaves with long internodes, early flowering or death before flowering in rice plants.
- In pineapple, auxin is used to promote flowering.
- Abscisic acid is also called stress hormone since it increases tolerance of plants to various kinds of stresses. It is produced in response to stress.

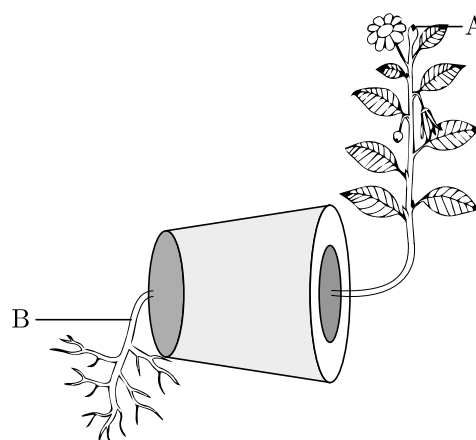
107. Differentiate between the following as indicated in brackets :

- Auxins and Gibberellins (Seed dormancy)
- Auxins and Cytokinins (Apical dominance)
- Gibberellins and Absciscic acid (Seed germination)
- Auxins and Absciscic acid (Growth)
- Thigmotropism and Chemotropism (movement of plants in response to)
- Auxins and Cytokinins (Scientist who discovered)
- Cuscuta* and *Drosera* (Type of tropic movement shown)
- IAA and ABA (Full form)

Ans :

MAIN 2006

(i)	Auxins No effect	Gibberellins (Seed dormancy) Suppresses
(ii)	Auxins Promotes	Cytokinins (Apical dominance) Inhibits
(iii)	Gibberellins Suppresses	Abscisic acid (Seed germination) Induces
(iv)	Auxins Promotes	Abscisic acid (Growth) Inhibits
(v)	Thigmotropism Touch stimulus	Chemotropism (Example) Chemical stimulus
(vi)	Auxins F.W.Went	Cytokinins (Scientist who discovered) Skoog & Miller
(vii)	<i>Cuscuta</i> Thigmotropism	<i>Drosera</i> (Type of tropic movement shown) Chemotropism
(viii)	IAA Indole acetic acid	ABA (Full form) Absciscic acid

108. The diagram shows an experiment on a type of tropic movement in plant.

- What is the aim of the experiment?
- What is A and B ?
- What is the observation of this experiment?
- Why is the movement of A and B in different directions?

Ans :

SQP 2010

- (i) To demonstrate that plants show geotropism.
- (ii) A-Shoot growing upward B-Root bending towards earth.
- (iii) The shoot will be found growing upwards after giving a curvature showing that it is negatively geotropic. The root grows downwards showing positive geotropism.
- (iv) Due to unequal distribution of auxin.

CASE BASED QUESTION

109. Students observed how growth in plants occurs through cell division at meristems near the shoot and root tips. They also learned that plants respond to environmental changes like light and gravity through hormones, which control growth without the need for a nervous system.

Answer the following questions:

1. Where does cell division for growth mainly occur in plants?
2. How do plants respond to changes without a nervous system?
3. What role do hormones play in plant growth?
4. Why don't plants need fast responses to small environmental changes?

Ans :

1. Meristems
2. Hormones
3. Growth
4. Adaptation

110. Cytokinins Application-Based Case: In a plant lab, students observed how cytokinins, in the presence of auxins, stimulated cell division and delayed ageing in leaves. They also noted that cytokinins promoted chlorophyll synthesis and helped break seed dormancy.

Answer the following questions:

1. How do cytokinins influence cell division?
2. In what way do cytokinins delay the ageing process in plants?
3. How do cytokinins help promote chlorophyll synthesis?
4. What role do cytokinins play in seed dormancy?

Ans :

1. Cell division
2. Anti-ageing
3. Chlorophyll synthesis
4. Germination

111. Students learned that plant growth regulators, also called phytohormones, control plant growth. These hormones are divided into growth promoters (Auxins, Gibberellins, Cytokinins) and growth inhibitors (Absciscic acid, Ethylene). The term "hormone" was introduced by William Bayliss and Ernest Starling.

Answer the following questions:

1. What are plant growth regulators also called?
2. Who introduced the term hormone?
3. Name the three growth-promoting hormones in plants.
4. Which two hormones act as growth inhibitors in plants?

Ans :

1. Plant growth regulators are also called phytohormones.
2. The term hormone was introduced by William Bayliss and Ernest Starling.
3. The three growth-promoting hormones in plants are Auxins, Gibberellins, and Cytokinins.
4. The two growth inhibitors in plants are Absciscic acid and Ethylene.

112. In a plant biology class, students studied auxins, a group of plant hormones produced in the root and shoot tips. These hormones play a key role in promoting cell elongation, fruit formation, and controlling apical dominance. Auxins can be either natural (IAA and IBA) or synthetic (2, 4-D and NAA) and have various effects on plant growth and development.

Answer the following questions:

1. Where are auxins produced in plants?
2. What is apical dominance, and how is it controlled by auxins?
3. How can auxins be used to induce fruit formation without fertilization?
4. Name two natural and two synthetic auxins.

Ans :

1. Root and shoot tips
2. Apical dominance
3. Parthenogenesis
4. IAA, IBA, 2, 4-D, NAA

113. In a plant biology experiment, students applied gibberellins to pea, bean, and tomato plants and observed increased leaf elongation and stem growth. They also induced artificial bolting in cabbage by applying gibberellins.

Answer the following questions:

1. What is the effect of gibberellins on seed germination?
2. How do gibberellins induce bolting in cabbage plants?
3. What is the role of gibberellins in fruit size in grapes?
4. Can gibberellins promote root growth?

Ans :

1. Germination
2. Bolting
3. Cell elongation
4. No

- 114.** In an agricultural study, students applied ethylene to bananas and observed rapid ripening. They also noticed that ethylene stimulated flowering in pineapples and mangoes and broke dormancy in potato tubers.

Answer the following questions:

1. How does ethylene affect the ripening of fruits like bananas and mangoes?
2. What is the effect of ethylene on flowering in pineapples?
3. How does ethylene break dormancy in buds and seeds?
4. Can ethylene inhibit stem elongation in plants?

Ans :

1. Ripening
2. Flowering
3. Dormancy break
4. Yes

- 115.** In a drought-stress experiment, students applied abscisic acid to plants and observed the temporary closure of stomata, reducing water loss. They also noticed that ABA induced bud dormancy and inhibited seed germination.

Answer the following questions:

1. How does abscisic acid help plants during drought conditions?
2. What is the role of ABA in inducing bud dormancy?
3. How does abscisic acid inhibit seed germination?
4. Why is abscisic acid called the "stress hormone"?

Ans :

1. Stomatal closure
2. Dormancy
3. Inhibition

4. Stress

- 116.** Students conducted an experiment on plant movements. They observed phototropism in sunflower stems bending towards light, geotropism in roots growing downward, and thigmotropism in tendrils of grapevine responding to touch.

Answer the following questions:

1. What is phototropism, and how do sunflower stems respond to light?
2. Describe the geotropism observed in roots in response to gravity.
3. How does thigmotropism help tendrils in climbing plants like grapevines?
4. What is hydrotropism, and how do roots respond to water?

Ans :

1. Phototropism
2. Geotropism
3. Thigmotropism
4. Hydrotropism

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CHAPTER 7

THE CIRCULATORY SYSTEM

SUMMARY

1. COMPONENTS OF CIRCULATORY SYSTEM

The main constituents of the circulatory system in human body are heart and blood vessels, e.g., artery, veins and capillaries by which the flow of blood occurs and is maintained. Essentially the two functional components in the circulatory system are (i) blood vascular system and (ii) lymph vascular system. The activity of heart consists in pumping of blood through the blood vessels which in turn continue to maintain the flow of blood.

2. FUNCTIONS OF BLOOD

Blood is a liquid connective tissue, which is red in colour, salty in taste with pH 7.4. It is a viscous sticky fluid with a specific gravity 1.05 to 1.06. The total quantity of blood in a full-grown human body is 4-6 litres. The main function of the blood is to carry oxygen to different parts of the body as every living cell respire (cellular respiration) with the oxygen carried by Hemoglobin of the blood. It removes unwanted excretory products like carbon dioxide, urea and uric acid. It also distributes hormones and digested food materials like amino acid, glucose and other dissolved food particles. It also protects our body from external germs. It is made-up of two principal components: the fluid matrix which is called plasma and blood cells called corpuscles suspended in the matrix.

3. CLOSED CIRCULATORY SYSTEM

In all vertebrates including human beings the blood flows through the closed vessels like arteries, veins and capillaries through a definite route without coming in direct contact with body cavity and space. This type of circulatory system is known as closed vascular system.

4. MYOGENIC HEART

The heart which is the main pumping organ is independent from the control of both nervous system and hormonal system. It is made-up of strong cardiac muscles, and situated between two lungs in the thoracic cavity protected by the ribcage. There are four chambers in the heart. Two auricles and two ventricles. Artery is the blood vessel which carries oxygenated blood while vein carries deoxygenated blood. The ultimate branch of artery and veins are called arterioles and venules. The lymph travels in the lymphatic vessels while there is tissue fluid which surrounds the cells. Lymph and tissue fluids are not red in colour due to absence of RBC (Red Blood Corpuscles).

5. COMPARISON OF AN ARTERY WITH A VEIN AND CAPILLARY

The Comparison between artery with a vein and capillary are as follows :

Co-ri-son	Artery	Vein	Capillary
Presence of valves	No	Yes	No
Internal diameter (lumen)	Fairly narrow; can expand (It is considered as pulse)	Fairly wide	Very narrow; red blood cells squeeze through
Wall structure	The wall is relatively thick and also elastic, to withstand pressure.	The wall is relatively thin; there are valves to keep blood moving in one direction.	Wall is composed of a single cell layer; gaps between cell allow exchange of materials with surrounding tissues.

discovery he was awarded Nobel Prize in 1931.

Landsteiner recognized two types of antigens or agglutinogens, i.e., A and B present on the plasma membrane of RBCs, hence, also known as corpuscle factors and two types of antibodies or agglutinins i.e., a and b in the plasma, hence, also called plasma factors.

The red blood corpuscles of an individual may possess either antigen A or antigen B or both the antigens or none of them. It is this distribution of antigens which determines the type of antibodies in the blood as all types of antigens and antibodies cannot coexist or are not compatible. Antigen A is not compatible with antibody a (or Anti-A) but compatible with antibody-b. Similarly, antigen B is incompatible with antibody-b (or Anti-B) but compatible with antibody a. Thus, A and b can exist together, and so can B and a. The antigens A and B can occur together if their antagonistic plasma factors a and b are lacking. Similarly, antibodies or agglutinins a and b can exist together if their antagonistic antigens A and B are absent.

Depending upon the distribution of antigens and antibodies in the blood, Landsteiner (1900) classified the blood into three groups and the fourth blood group was reported by Decastello and Sturli two years later. The four types of blood groups are named according to the type or types of antigens present and are A, B, AB and O. The antigens and antibodies present in these blood groups are given in the table below.

Table : Various blood groups, their composition and transfusion ability.

Blood group	Antigen present	Antibody present	Can donate blood to	Can receive blood from
A	A	B	A and AB	A and O
B	B	A	B and AB	B and O
AB	A and B	None	AB	All
O	None	A and B	All	O

15. BLOOD TRANSFUSION

In cases of severe blood loss due to some accident or various diseases also and in serious forms of anaemia caused by other reasons, the transfusion of blood is the only method to save life. It is also necessary during prolonged and serious

operations to restore the normal vital activities of the body. A person who donates blood is called the donor and the person who receives it, is called the recipient.

In blood transfusion, the corpuscle factor or antigen of the donor should be compatible with the plasma factor or antibody of the recipient, otherwise the corpuscles of blood donated become agglutinated and block the blood vessels and may prove fatal. The plasma factor of the donor is not significant during transfusion as it gets diluted when mixed with the plasma of recipient and is not able to cause agglutination of RBCs of the recipient. According to this principle, a person can receive or donate blood to the other blood groups as given in the table above.

15.1 Universal Donor and Universal Recipients

People belonging to blood group O have no antigen or corpuscle factor in their RBCs. Their blood can be administered to any other person, because neither of the antibodies a and b will agglutinate these cells, hence, they are called universal donors. On the other hand, people belonging to blood group AB have both the antigens in their RBCs, but no antibodies in their plasma. So these persons can receive blood from persons of any blood group, and are, therefore, called universal recipients.

16. RH FACTOR

Landsteiner and Weiner (1940) discovered the presence of another factor in the red blood corpuscles of Rhesus monkey and some humans which they named as Rh factor. This Rh factor is found in 85% of white population and 93% of Indian population.

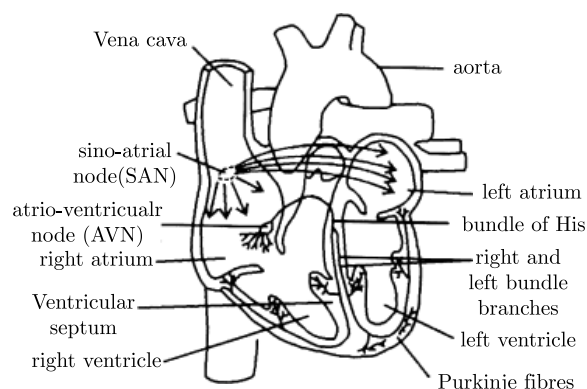
A person is said to be Rh positive if its RBCs contain Rh antigen and Rh negative if he has no Rh antigen on his RBCs. Normally, the blood of the Rh negative person does not carry any antibody that can react with this antigen. But such antibodies are produced if Rh negative blood comes across Rh positive blood. In such cases the transfused Rh positive blood acts as foreign bodies to the Rh negative person and his body proceeds to produce antibodies called anti-Rh to destroy the foreign bodies i.e., transfused Rh positive red blood corpuscles. First transfusion is not going to be serious but repeated transfusions may result in severe reaction and ultimately lead to the death of Rh negative person.

to the lungs and through the aorta to the rest of the body. This takes 0.3 seconds.

3. **Atrial diastole** : The atria relax, although the ventricles are still contracted. Blood enters the atria from the large veins coming from the body. This takes about 0.7 seconds.
4. **Ventricular diastole** : The ventricles relax, and become ready to fill with blood from the atria as the next cycle begins. This takes about 0.5 seconds. Given an average heart rate of 75 beats per minute, each cycle takes 0.8 seconds.

8.1 Control of the Cardiac Cycle

Heartbeat must be carefully controlled so that each chamber contracts only when full of blood. To achieve this, the events of the cardiac cycle are carefully coordinated.



A single heartbeat starts with an electrical signal from a region of specialized tissue called the sino-atrial node (SAN), on the wall of the right atrium. This is the 'pacemaker', or heartbeat regulator. The electrical signal spreads out over the walls of the atria, causing them to contract.

From there, the signal does not pass directly to the ventricles. If it did, the ventricles would begin to contract before they had filled with blood. Instead, the impulse is delayed slightly. A second node, the atrioventricular node (AVN) picks up the signal and channels it down the middle of the ventricular septum through a collection of specialised cardiac muscle fibres called the bundle of His. From here the signal spreads throughout the wall of the ventricles, through the Purkinje fibres, and the ventricles contract after they have filled with blood.

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9. COMPOSITION OF BLOOD

9.1 Plasma

Plasma is the fluid part of blood. The exact composition of the plasma varies greatly. For instance, in the hepatic portal vein, which leads from the intestines to the liver, the plasma is much richer in dissolved foods such as sugars, vitamins and amino acids than the plasma in a vein in another part of the body.

The main constituents of plasma

	Components	Function
Proteins	Albumin Antibodies Fibrinogen	Osmotic balance Immunity Blood clotting
Salts	Sodium, potassium, chloride bicarbonate (hydrogencarbonate) calcium	Osmotic balance, conduction of nerve impulses carriage of O ₂ , blood clotting
Products of digestion	glucose, amino acids, fatty acids, glycerol, vitamins.	Nourishment of cells
Hormones	Protein, e.g., insulin ; lipid (steroids), e.g. testosterone	Communication
Heat	Distributed around body to maintain constant body temperature	
Oxygen Waste products	Vital in aerobic cell respiration Urea, CO ₂	None : they must be removed by excretion.

9.2 Red Blood Cells

Mammalian red blood cells have nucleus. They contain Hemoglobin, enzymes and chemicals that allow them to function effectively. Red blood cells have one function: they carry the respiratory gases. The Hemoglobin (Hb) they contain, picks up oxygen in the lungs and swaps it for carbon dioxide in the respiring tissues.

Having the Hb inside red blood cells rather than in solution in the plasma gives several advantages.

1. A much greater volume of Hb can be carried in cells that could be dissolved in plasma.
2. Hb can be kept in a favourable chemical environment to allow faster loading and unloading of respiratory gases.
3. Hb molecules of a particular age are kept together and can be replaced easily when old.

18.3 Lymph Vessels

Lymph capillaries join to form lymph vessels. Lymph vessels resemble the veins in structure but have thinner walls and more valves. The smaller lymph vessels join to form larger vessels, which in turn unite to form two main lymphatic vessels or trunks called thoracic duct and right lymphatic duct. The thoracic duct finally opens into left subclavian vein and the right thoracic duct opens into right subclavian vein.

18.4 Lymph Nodes

Throughout the course of lymph vessels at intervals are present bead like swellings called lymph nodes. They are masses of reticular connective tissue wrapped in a capsule of fibrous tissue. They contain lymphocytes, plasma cells and fixed macrophages. The lymph is filtered through the lymph nodes. Macrophages engulf micro-organisms and foreign particles from the lymph. The lymph nodes also add lymphocytes and antibodies to the lymph from where these are carried to the blood.

Lymph nodes are abundant in the regions of neck, armpits and groins. Tonsils and adenoids are masses of lymphatic tissues. Thymus and spleen are important lymphatic organs in the body of vertebrates.

18.5 Functions of Lymph

The lymph performs many functions such as :

- (i) It acts as a 'middleman' and helps in the exchange of various materials between blood and body tissues.
- (ii) It carries lymphocytes and antibodies from lymph nodes to the blood.
- (iii) It transports fats (fatty acids and glycerol) from the intestine to the blood.
- (iv) It destroys microorganisms and foreign particles in the lymph nodes.
- (v) It drains excess of tissue fluid from intercellular spaces back into the blood.
- (vi) Spleen as a lymphatic organ acts as 'blood bank' and 'graveyard' of RBCs.
- (vii) It carries the plasma proteins synthesized in the liver cells and hormones from endocrine glands to the blood.

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MULTIPLE CHOICE QUESTION

1. During ventricular systole, the atrioventricular valves (*P*) and semilunar valves (*Q*)
 (a) *P* — close, *Q* — Open
 (b) *P* — close, *Q* — Close
 (c) *P* — open, *Q* — Close
 (d) *P* — open, *Q* — Open

Ans :

SQP 2025

Thus (a) is correct option.

2. Pulse wave is mainly caused by the :
 (a) Systole of atria
 (b) Diastole of atria.
 (c) Systole of the left ventricle
 (d) Systole of the right ventricle.

Ans :

MAIN 2013

The pulse is felt over the wrist in the superior artery due to the forceful pumping of blood into the arteries during ventricular systole.

For each left ventricular contraction or systole, the blood is forced towards arteries to provide systemic circulation of oxygenated blood and then released towards the tissues during diastole. Thus (c) is correct option.

3. The mineral ion needed for the formation of blood clot is
 (a) Potassium (b) Sodium
 (c) Calcium (d) Iron

Ans :

COMP 2016

The mineral ion needed for the formation of a blood clots is calcium. Thus (c) is correct option.

4. The mineral element in hemoglobin :
 (a) Manganese (b) Iron
 (c) Sodium (d) Calcium

Ans :

SQP 2021

Iron is a mineral found in every cell of the body. Iron is considered an essential mineral because it is needed to make hemoglobin, a part of blood cells.

Thus (b) is correct option.

5. Pericardium covers the :
 (a) Heart (b) Brain
 (c) Spinal cord (d) Eyeball

Ans :

COMP 2021

10. BLOOD CLOTTING OR COAGULATION

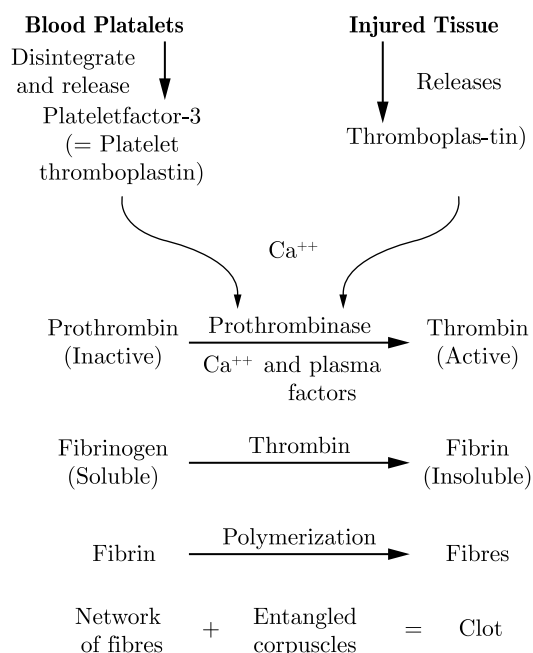
Clotting or coagulation of blood is of great biological value for the survival of animals. When a vessel is injured, a blood clot forms at the site of injury. This acts as a plug, thereby sealing the ruptured blood vessel. It stops bleeding and prevents loss of vital body fluid. A decrease in capacity of the blood to clot leads to profuse and fatal haemorrhages even if the injury is slight.

10.1 Mechanism of Blood Clotting

The blood clotting involves a series of chemical reactions taking place in a rapid sequence. There are following three steps :

First step : At the site of injury a phospholipid called platelet factor-3 (= platelet thromboplastin) is released by the disintegration of blood platelets. Another lipoprotein factor called thromboplastin is also released by the injured tissue. The two factors so released combine with calcium ions and some plasma proteins to form an enzyme called thrombokinase or prothrombinase.

Second step : Thrombokinase enzyme converts inactive plasma protein prothrombin into active form called thrombin. This activity needs Ca^{++} and some plasma factors.



Mechanism of blood clotting

Third step : Soluble plasma protein fibrinogen is converted into insoluble protein called fibrin with the help of thrombin. By the polymerization the fibrin protein forms long fibrin threads. These fibrin threads form a very fine network (mesh) at

the site of injury, in which RBCs get entangled and form a clot. A clot is formed at the injury within 2-6 minutes. Soon after its formation, the clot starts contracting and a pale yellow fluid-the serum starts oozing out.

Why does blood not clot within the blood vessels? The blood contains an anticoagulant called heparin (antithrombin) that does not allow the formation of prothrombinase within the blood vessels.

In certain diseases blood clots are formed within the blood vessels. These clots are called thrombi and their formation is called thrombosis. Thrombosis in coronary artery (artery that supplies blood to heart muscles) leads to heart attack. When a thrombus is transported by the bloodstream it is called embolus which causes embolism when lodged in a vessel and cuts off circulation.

10.2 Role of Vitamin K in Blood Clotting

Vitamin K is essential for the synthesis of prothrombin and fibrinogen proteins by the liver cells. These proteins are essential for the clotting of blood.

11. ANTICOAGULANTS

The substances which prevent clotting of blood are called anticoagulants.

Sodium oxalate, Sodium citrate are used as anticoagulants. Heparin in our blood and hirudin found in the salivary glands of leeches are also anticoagulants.

12. BLOOD BLISTERS

Blood blisters are formed without the blood coming in contact with air. These may be formed due to injuries like sharp pinch when the skin does not break.

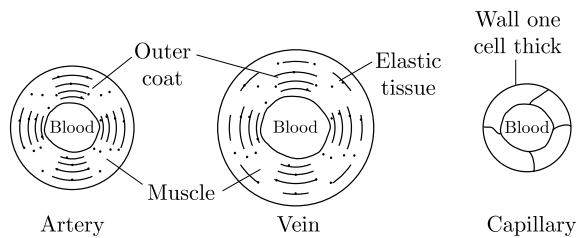
13. DEFIBRINATED BLOOD

Blood from which fibrin has been removed is called defibrinated blood. It consists of serum and formed elements and does not clot.

14. ABO, BLOOD GROUPS

Carl Landsteiner (1900) was the first, who discovered that the blood of individuals differed chemically. The clumping of red blood corpuscles (agglutination) occurred when the blood of different chemical types was mixed with. For this

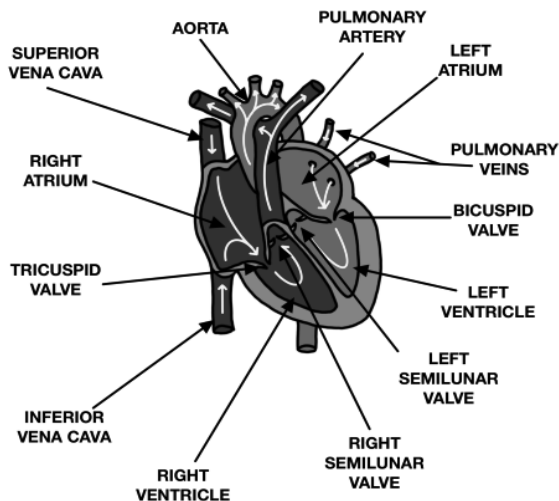
Blood direction	Blood flows away from the heart	Blood flows towards the heart	Blood flows from arteries to veins
Blood pressure	High	Low	Very low
Blood flow rate	Rapid, irregular	Slow, regular	Very slow



6. STRUCTURE OF THE HEART

The mammalian heart is composed mainly of cardiac muscle : a specialize tissue that can contract automatically, powerfully and without fatigue, throughout the life of the organism.

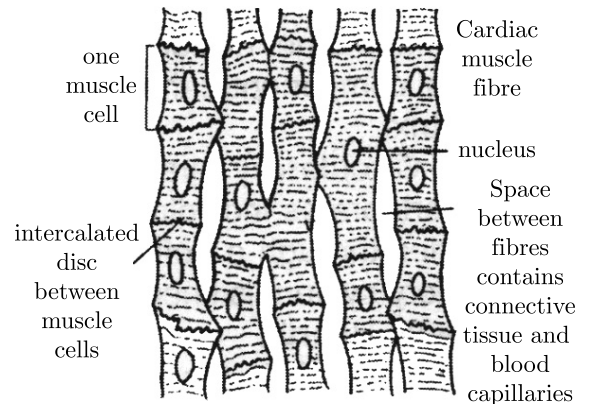
It is important that blood flows through the heart in one direction only. Two sets of valves close to prevent back flow :



6.1 The Atrioventricular Valves (AV valves)

These lie between the atria and the ventricles to prevent blood from returning to the atria when the ventricles contract. The tricuspid valve on the right side has three cusps, or flaps. The bicuspid valve, or mitral valve, on the left has two cusps. Both AV valves are subjected to great pressure and ultra-tough tendinous cords are needed to prevent them turning inside out. The semilunar

valves guard the openings to the pulmonary artery and the aorta to prevent backflow of blood into the ventricles. Both valves have three semilunar (half moon-shaped) cusps.



6.2 Heart Disorders

In a heart attack, also called a myocardial infarction, the blood flows to a particular part of the heart is blocked and that region of myocardium (heart muscle) dies. The body can recover if only a small area of muscle dies, but extensive infarctions are often fatal.

7. TYPES OF HEARTBEAT

The heart continues to beat when removed from the body. Individual heart muscle cells grown in culture beat on their own. Because of this, we say that vertebrate heart is myogenic : the stimulus that drives it to beat originates in the muscle itself. Some invertebrate hearts are neurogenic : they beat only when connected to external nerves. If a heart attack damages the conducting system of the heart, the co-ordination of the heartbeat can be disrupted. This condition is often called a heart block. A patient with a permanent heart block can be fitted with an artificial pacemaker.

8. CARDIAC CYCLE

The sequence of events in a single heartbeat is known as the cardiac cycle. The cycle involves systole (or contraction) and also diastole (or relaxation) of the atria and ventricles. The cycle has four overlapping stages.

1. **Atrial systole** : Both atria contract, forcing blood into the ventricles. This stage lasts 0.1 seconds.
2. **Ventricular systole** : Both ventricles contract, forcing blood through the pulmonary artery

16.1 Rh Factor in Pregnancy

Rh factor is very important as it is inheritable. If an Rh negative woman marries an Rh positive man and conceives an Rh positive foetus, the first baby may be safe, but following Rh-positive foetuses will die in the womb or soon after birth. It is because of the fact that Rh-positive foetus induces the formation of anti-Rh agglutinin in the Rh- negative blood of mother. During first pregnancy, the formation of anti-Rh agglutinin is very slow and does not affect the RBCs of foetus. But in the succeeding Rh-positive foetus, the result will be disastrous, as already present anti-Rh antibodies in mother's blood will pass to the foetus through placenta causing agglutination of RBCs of foetus. It may lead to the death of foetus or newborn baby. This disease is called erythroblastosis foetalis.

17. PORTAL SYSTEM

- (i) A vein which collects blood from one organ by one set of capillaries and distributes blood to some other organ by another set of capillaries instead of sending it to the heart is called a portal vein.
- (ii) A portal vein together with the capillaries by which it supplies blood to a specific organ forms a portal system.
- (iii) A portal system is named after the organ to which it carries blood.
- (iv) The vertebrates have 2 or 3 portal systems : hepatic, renal and hypophyseal.
- (v) Hepatic Portal System : It is present in all vertebrates, including man. It carries the venous blood from the alimentary canal, pancreas and spleen to the liver, hence its name.
- (vi) Significance.
 - (a) It brings the digestion products, such as glucose and amino acids, from the alimentary canal to the liver. The liver retains the excess sugar and converts it into glycogen, which is stored for future use. The liver also deaminates the unwanted amino acids, releasing only those that are necessary for the body.
 - (b) The liver converts the harmful ammonia resulting from deamination into urea for removal by the kidneys.
 - (c) Liver synthesises certain useful substances and releases them into the blood for use in the body tissues. These include heparin, fibrinogen, prothrombin and vitamin A.

18. LYMPHATIC SYSTEM

Lymph (a colourless fluid) and its associated parts constitute lymphatic system. It consists of (A) Lymph (B) Lymph capillaries (C) Lymph vessels (D) Lymph nodes.

18.1 Lymph

Lymph is a colourless or straw coloured fluid connective tissue. It is actually a part of tissue fluid which in turn is filtered out plasma through the walls of capillaries. So the composition of lymph is like that of blood plasma minus plasma proteins which cannot pass through the walls of capillaries. Source of lymph is blood. Lymph acts as a middle man for the exchange of various materials between the blood and body tissues.

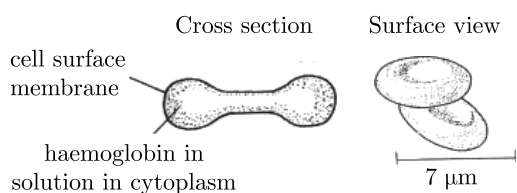
Table : Differences between blood and lymph			
	Blood		Lymph
1.	It is red in colour.	1.	It is colourless or straw yellow coloured.
2.	Erythrocytes are present.	2.	Erythrocytes are absent.
3.	Hemoglobin is present.	3.	Hemoglobin is absent.
4.	It contains many plasma proteins.	4.	Plasma proteins are absent or very low concentration.
5.	Calcium and phosphorus concentration is very high.	5.	Low concentration of calcium and phosphorus.
6.	It flows in blood vessels.	6.	It flows in lymph vessels and also bathes various body tissues.
7.	It helps in the transportation of various materials.	7.	It acts as a middleman for the exchange of materials between blood and body tissues.

18.2 Lymph Capillaries

Interwoven with the blood capillaries are present lymph capillaries which are blind at one end. They have very thin walls. Lymph flows into lymph capillaries.

4. Hb in cells does not increase the solute potential of the blood (free Hb would).

Red blood cells have a very regular shape, described as a biconvex disc. When you think about what red blood cells do, it is easy to see why this is a good shape for them. They must have a large enough volume to carry useful amounts of oxygen but they also need a large enough surface area to load and unload it quickly. The biconvex shape is an efficient compromise between the maximum volume of a sphere and the maximum surface area of a flat disc. Red blood cells are distorted when they have to squeeze through capillaries that often have lumens slightly smaller than the diameter of the red cell. Red cells rarely cause blockages because they have a flexible shape and a smooth membrane.



Mammalian blood cells are biconcave discs filled with Hemoglobin

(Red blood cells are made in the bone marrow of the vertebrate, ribs and pelvis by specialised stem cells. The turnover of red cells is very rapid: we make about 20 million red cells per second. Red blood cells circulate for about 100 to 120 days before they are destroyed in the liver by the phagocytes called Kupffer cells, and also in the spleen.)

9.3 WBC's or Leucocytes (White Blood Corpuscles)

The leucocytes in general are amoeboid (i.e., without any definite shape) nucleated corpuscles. They are known as phagocytes- (engulf the foreign and worn out structures) Scavengers – (engulf the worn out tissues of the body) Soldiers of the body (accumulate at the site of injury and fight with the invading microorganisms, that may cause infection).

The leucocytes vary from 5000-9000/mm³ of human blood. They are produced either in the bone marrow or in lymphoid tissues such as lymph nodes, spleen, etc. Extraordinary increase in the number of leucocytes is called leukemia and decrease in their number is called leucopenia.

Types of Leucocytes :

Based upon the structure, the leucocytes are classified into two types which are further

categorized as follows :

- (a) **Agranular Leucocytes or Agranulocytes** : Agranulocytes are the leucocytes whose cytoplasm is not granular in appearance. They are produced in the lymph nodes, spleen and other lymphoid tissues. These are further of two types :
 - (i) **Monocytes** : They have the largest size amongst leucocytes. A monocyte is a large amoeboid cell having a large kidney-shaped nucleus.
 - (ii) **Lymphocytes** : They are of the size of RBC and are round in shape having a very large nucleus that almost fills the whole of the cell. They produce antibodies that provide immunity against specific diseases.
- (b) **Granular Leucocytes (Granulocytes)** : Granulocytes have granular cytoplasm. All the granulocytes are produced in the red bone marrow. Depending upon the chemical nature of their cytoplasm they are classified into three types.
 - (i) **Acidophils (Eosinophils)** : Their cytoplasm is alkaline in nature. An acidophil has a bilobed nucleus.
 - (ii) **Basophils** : Their cytoplasm is acidic, hence, take basic stains. Their nucleus is 3-lobed.
 - (iii) **Neutrophils** : These form about 70% of the total leucocytes. Its cytoplasm is neutral. Its nucleus is many lobed. They are phagocytic.

Functions of Leucocytes :

Defence of the body against diseases and invaders is the most essential function of leucocytes. They perform various functions such as

- (i) Phagocytosis
- (ii) Formation of antibodies and antitoxins
- (iii) Immunity
- (iv) Metamorphosis

9.4 Blood Platelets (Thrombocytes)

They are the smallest corpuscles of all the three types in regard to their size. They are denucleated. They are also produced in the red bone marrow from some giant cells called megakaryocytes. Its lifespan is about 3-5 days and are mainly destroyed in the spleen.

Functions of Platelets :

The blood platelets are responsible for the clotting of blood at injuries.

The pericardium is a double-walled sac that encloses and protects the heart. It provides lubrication to reduce friction between the heart and surrounding structures during heartbeats, and it helps to anchor the heart in the chest cavity.

Thus (a) is correct option.

6. The blood vessel that carries oxygenated blood is :

- (a) Pulmonary artery
- (b) Pulmonary vein
- (c) Renal vein
- (d) Hepatic vein

Ans :

MAIN 2021

The pulmonary arteries carry deoxygenated blood from the right ventricle to the lungs. The pulmonary veins carry oxygenated blood from the lungs to the left atrium.

Thus (a) is correct option.

7. The nearest organ to which the heart supplies oxygenated blood is

- (a) Kidney
- (b) Heart
- (c) Lung
- (d) Intestine

Ans :

COMP 2021

The nearest organ to which the heart supplies oxygenated blood is a lung.

Thus (b) is correct option.

8. A patient's blood clotting is examined, and it's observed that a substance helps in the clot formation by converting prothrombin to thrombin. Thrombokinase is :

- (a) an antibody
- (b) an enzyme
- (c) released by platelets
- (d) a waste product

Ans :

SQP 2004

Thrombokinase is an enzyme present in blood platelets and it converts prothrombin into thrombin. The enzyme aids in the process of blood clotting.

Thus (c) is correct option.

9. The chamber of heart which send deoxygenated blood to the lungs

- (a) Right auricle
- (b) Left auricle
- (c) Right ventricle
- (d) Left ventricle

Ans :

MAIN 2000

Blood enters the right atrium and passes through the right ventricle. The right ventricle pumps the blood to the lungs where it becomes oxygenated. Thus (c) is correct option.

10. A doctor mentions that certain blood vessels allow the exchange of gases and nutrients. The exchange of gases, nutrients, etc. is done by:

- (a) Capillaries, veins and arteries
- (b) Capillaries and arteries
- (c) Capillaries and veins
- (d) Capillaries only

Ans :

COMP 2009

Exchange of Gases, Nutrients, and Waste Between Blood and Tissue Occurs in the Capillaries. Capillaries are tiny vessels that branch out from arterioles to form networks around body cells.

Thus (d) is correct option.

11. The opening of right auricle into the right ventricle is guarded by

- (a) Bicuspid valve
- (b) Tricuspid valve
- (c) Aortic semi-lunar valve
- (d) Pulmonary semi-lunar valve

Ans :

SQP 2020

The right atrioventricular opening is guarded by the tricuspid valve, as it has three flaps.

Thus (b) is correct option.

12. Rate of heart beat is controlled by

- (a) Cranial nerves
- (b) SA node
- (c) Sympathetic nerves
- (d) Spinal nerves

Ans :

SQP 2007

Heart rate is controlled by the two branches of the autonomic (involuntary) nervous system. The sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The sympathetic nervous system (SNS) releases the hormones (catecholamines - epinephrine and norepinephrine) to accelerate the heart rate.

Thus (b) is correct option.

13. Double circulation means

- (a) Oxygenated and deoxygenated blood is separated
- (b) Every organ has an artery and a vein
- (c) Blood flows twice through the heart
- (d) Both (a) and (b)

Ans :

MAIN 2023

A mechanism in which blood circulates twice through the heart in one complete cycle is known as double circulation. Systemic circulation and pulmonary circulation are two pathways in which the blood flows in double circulation. Double circulation is present in birds and mammals. Thus (d) is correct option.

14. In man, the portal vein carries blood from the intestine to the

(a) Liver (b) Kidney
(b) Heart (d) Both (a) and (b)

Ans :

SQP 2004

In humans, the portal vein carries nutrient-rich blood from the intestine and other parts of the digestive system to the liver. The liver processes the nutrients and detoxifies harmful substances before the blood is circulated to the rest of the body. Thus (a) is correct option.

15. Normal blood pressure in human is

(a) 80/120 mm Hg (b) 80/110 mm Hg
(c) 100/80 mm Hg (d) 120/80 mm Hg

Ans :

COMP 2019

Normal blood pressure for most adults is defined as a systolic pressure of less than 120 and a diastolic pressure of less than 80.

Thus (d) is correct option.

16. Which of the following cells do not exhibit phagocytic activity?

(a) Monocytes (b) Neutrophil
(c) Macrophage (d) Basophil

Ans :

MAIN 2021

Phagocytes have the ability to phagocytose or kill foreign cells and particles like pathogens by ingesting them. Many blood cells have this function, including monocytes, neutrophils and macrophages. Basophils do not have phagocytic activity.

Thus (d) is correct option.

17. Systemic circulation is

(a) Left ventricle $\xrightarrow{\text{Deoxygenated blood}}$ Tissues $\xrightarrow{\text{Oxygenated blood}}$ Right ventricle
(b) Right ventricle $\xrightarrow{\text{Oxygenated blood}}$ Tissues $\xrightarrow{\text{Deoxygenated blood}}$ Right auricle
(c) Left ventricle $\xrightarrow{\text{Deoxygenated blood}}$ Tissues $\xrightarrow{\text{Oxygenated blood}}$ Right auricle
(d) Left ventricle $\xrightarrow{\text{Oxygenated blood}}$ Tissues $\xrightarrow{\text{Deoxygenated blood}}$ Right auricle

Ans :

MAIN 2000

Systemic circulation carries oxygenated blood from the left ventricle, through the arteries, to the capillaries in the tissues of the body. From the

tissue capillaries, the deoxygenated blood returns through a system of veins to the right atrium of the heart.

Thus (d) is correct option.

18. Bicuspid and tricuspid valves are closed during

(a) Ventricular diastole
(b) Ventricular systole
(c) Atrial systole
(d) Late joint diastole

Ans :

SQP 2017

Semilunar valves are open during ventricular systole, forcing the blood to flow into the pulmonary artery. Bicuspid and tricuspid valves get closed at the beginning of ventricular systole. Thus (b) is correct option.

19. The chief function of lymph nodes in mammals is to

(a) Produce hormones (b) Produce WBCs
(c) Destroy old RBCs (d) Destroy pathogen

Ans :

MAIN 2015

The chief function of lymph nodes in the mammalian body is to collect and destroy pathogens.

Thus (b) is correct option.

20. Which one of the following blood vessels carries only deoxygenated blood?

(a) Pulmonary artery
(b) Pulmonary vein
(c) Aorta
(d) Capillaries

Ans :

SQP 2016

Capillaries are thin-walled vessels composed of a single endothelial layer. Because of the thin walls of the capillary, the exchange of nutrients and metabolites occurs primarily via diffusion. The arteriolar lumen regulates the flow of blood through the capillaries.

Thus (a) is correct option.

21. Find the incorrect statement from the following

(a) Because of their small size, capillaries contain blood that moves more quickly than in other part of circulation.
(b) Veins are larger in diameter than arteries.
(c) Wall of arteries are elastic, enabling them to stretch and shrink during changes in blood pressure.
(d) Veins contain maximum amount of blood.

Ans :

MAIN 2001

Capillaries are small in size, but blood moves more slowly through them compared to other parts of circulation. This slower movement allows for the exchange of oxygen, nutrients, and waste between the blood and tissues. The rest of the statements are correct: veins are larger in diameter than arteries, arterial walls are elastic, and veins contain the maximum amount of blood.

Thus (a) is incorrect option.

22. The first heart sound is produced when
- Bicuspid and tricuspid valves close quickly
 - Diastole begins
 - Semilunar valves close quickly
 - Inter-ventricular pressure increases

Ans :

SQP 2006

First heart sound is produced by the closing of the atrioventricular valves. The first heart sound, or S_1 , forms the "lub" of "lub-dub" and is composed of components M_1 (mitral valve closure) and T_1 (tricuspid valve closure). Normally M_1 precedes T_1 slightly. It is caused by the closure of the atrioventricular valves, i.e. tricuspid and mitral (bicuspid), at the beginning of ventricular contraction, or systole. So, the correct option is C. (Bicuspid and tricuspid close quickly)

Thus (a) is correct option.

23. Rate of heart beat is controlled by
- Cranial nerves
 - SA node
 - Sympathetic nerves
 - Spinal nerves

Ans :

COMP 2022

Heart rate is controlled by the two branches of the autonomic (involuntary) nervous system. The sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The sympathetic nervous system (SNS) releases the hormones (catecholamines - epinephrine and norepinephrine) to accelerate the heart rate.

Thus (b) is correct option.

24. Which of the following substances if introduced into bloodstream, would cause coagulation at the site of introduction?
- Fibrinogen
 - Prothrombin
 - Thromboplastin
 - Heparin

Ans :

SQP 2011

Thromboplastin is a substance that, when introduced into the bloodstream, triggers the coagulation process at the site of introduction. Thromboplastin initiates the conversion of prothrombin into thrombin, which in turn converts fibrinogen into fibrin, leading to blood clot formation.

Thus (c) is correct option.

25. Non-granular WBCs are :

- Lymphocytes and basophils
- Eosinophils and basophils
- Lymphocytes and monocytes
- Eosinophils and monocytes

Ans :

COMP 2018

Non-granular white blood cells (WBCs), also known as agranulocytes, are lymphocytes and monocytes. These cells lack the granules present in other types of WBCs such as neutrophils, eosinophils, and basophils. Lymphocytes play a key role in the immune response, and monocytes are involved in phagocytosis.

Thus (c) is correct option.

26. SA node is called the pacemaker of the heart because
- it generates the cardiac impulse
 - it conducts the impulse from AV node
 - it is present in the right atrium
 - it is made up of specialised muscle fibres

Ans :

SQP 2001

The SA node (sinoatrial node) is called the pacemaker of the heart because it generates the cardiac impulse that initiates each heartbeat. The SA node creates electrical signals that spread throughout the heart, causing the atria and then the ventricles to contract in a coordinated manner. This maintains the heart's rhythm.

Thus (a) is correct option.

27. Systolic pressure in normal adult human is

- 80 mm
- $\frac{120}{80}$ mm Hg
- $\frac{150}{120}$ mm Hg
- 120 mm Hg

Ans :

MAIN 2019

The normal systolic pressure in a healthy adult human is approximately 120 mm Hg. Systolic

Ans :

SQP 2013

The pulse wave is mainly caused by the systole of the left ventricle

Thus (a) is correct option.

DIRECTION : Conversation Type Question

68. A biology teacher asked her students to give two examples of excretory organs in the human body.

Raj said : - Kidneys and lungs

Sonu said : - Liver and pancreas

Lata said : - Kidneys and skin

Abhay said : - Lungs and large intestine

Who were correct?

- (a) Raj and Lata
- (b) Sonu and Abhay
- (c) Lata and Abhay
- (d) Raj and Abhay

Ans :

MAIN 2002

Kidneys and lungs are correct excretory organs, as kidneys excrete urine and lungs expel carbon dioxide. Skin also excretes salts and urea through sweat. Thus (c) is the correct option.

69. A biology teacher asked her students to give two examples of connective tissues in the human body.

Raj said : - Blood and cartilage

Sonu said : - Bone and muscle

Lata said : - Cartilage and tendon

Abhay said : - Muscle and blood

Who were correct?

- (a) Raj and Lata.
- (b) Sonu and Lata.
- (c) Raj and Sonu.
- (d) Abhay and Lata.

Ans :

SQP 2005

Blood, cartilage, and tendon are connective tissues. Muscles are not classified as connective tissue but as muscular tissue. Thus (d) is the correct option.

70. A biology teacher asked her students to give two examples of plant hormones.

Raj said : - Auxin and cytokinin.

Sonu said : - Cytokinin and insulin.

Lata said : - Gibberellin and auxin.

Abhay said : - Insulin and gibberellin.

Who were correct?

- (a) Raj and Lata
- (b) Sonu and Lata
- (c) Abhay and Raj
- (d) Sonu and Abhay

Ans :

COMP 2010

Auxin, cytokinin, and gibberellin are plant hormones. Insulin is a hormone in animals, not plants. Thus (b) is the correct option.

71. A biology teacher asked her students to give two examples of enzymes involved in digestion.

Raj said : - Amylase and lipase

Sonu said : - Pepsin and insulin

Lata said : - Amylase and pepsin

Abhay said : - Trypsin and insulin

Who were correct?

- (a) Raj and Lata
- (b) Raj and Abhay
- (c) Lata and Sonu
- (d) Sonu and Abhay

Ans :

MAIN 2015

Amylase, lipase, pepsin, and trypsin are digestive enzymes. Insulin is a hormone, not an enzyme. Thus (a) is the correct option.

- A biology teacher asked her students to give two examples of carbohydrates.

Raj said : - Glucose and fructose.

Sonu said : - Glucose and protein.

Lata said : - Starch and glucose.

Abhay said : - Protein and fructose.

Who were correct?

- (a) Raj and Lata
- (b) Sonu and Abhay
- (c) Lata and Abhay
- (d) Raj and Sonu

Ans :

SQP 2000

Glucose, fructose, and starch are carbohydrates. Proteins are macromolecules made of amino acids, not carbohydrates. Thus (a) is the correct option.

DIRECTION : Matching Type Question

73. Priya tried to match the components of the blood with their characteristics. She tabulated the pairs as follows:

Blood Component	Characteristic
P	Biconcave shape and no nucleus
Q	Involved in clotting of blood

Identify the correct pair of blood components.

- (a) P – White Blood Cells, Q – Red Blood Cells
- (b) P – Platelets, Q – White Blood Cells
- (c) P – Red Blood Cells, Q – Platelets
- (d) P – Plasma, Q – Platelets

The duration of a normal cardiac cycle in a healthy adult is approximately 0.8 seconds. This includes both systole (contraction) and diastole (relaxation) of the heart, which allows for one complete heartbeat.

Thus (d) is correct option.

35. Hepatic portal system starts from

- (a) Kidney to liver
- (b) Liver to heart
- (c) Digestive system to liver
- (d) Liver to kidney

Ans :

SQP 2018

The hepatic portal system is a network of veins that carries blood from the digestive system to the liver. This system allows the liver to process nutrients, detoxify harmful substances, and regulate blood sugar before the blood enters general circulation.

Thus (c) is correct option.

36. The instrument by which Blood Pressure is determined

- (a) Ultrasound
- (b) BP meter
- (c) Sphygmomanometer
- (d) Stethoscope

Ans :

MAIN 2000

The instrument used to determine blood pressure is called a sphygmomanometer. It typically consists of an inflatable cuff to restrict blood flow, a measuring unit (a mercury column or gauge), and sometimes a stethoscope to listen to the blood flow.

Thus (c) is correct option.

37. When two atria contract simultaneously and result in the blood pumping into ventricles, this is called

- (a) Arterial diastole
- (b) Ventricular systole
- (c) Ventricular diastole
- (d) Arterial systole

Ans :

SQP 2012

When the two atria contract simultaneously to pump blood into the ventricles, this phase is called atrial systole (or arterial systole). During this phase, the atria contract to push blood into the ventricles, which are in a relaxed state (diastole). Thus (d) is correct option.

38. Blood is a

- (a) Liquid connective tissue
- (b) Mobile connective tissue
- (c) Both (a) and (b)
- (d) Semi-solid connective tissue

Ans :

COMP 2015

Blood is considered both a liquid connective tissue and a mobile connective tissue. It is classified as connective tissue because it consists of cells suspended in a liquid matrix (plasma) and performs vital functions like transport of nutrients, gases, and waste products, while also circulating throughout the body.

Thus (c) is correct option.

39. Which of the following chambers of heart first receives blood from the systemic circulation?

- (a) Left ventricle
- (b) Right ventricle
- (c) Left auricle
- (d) Right auricle

Ans :

COMP 2023

The right auricle (or right atrium) is the first chamber of the heart that receives deoxygenated blood from the systemic circulation through the superior and inferior vena cava. From there, the blood is pumped into the right ventricle before being sent to the lungs for oxygenation.

Thus (d) is correct option.

40. The valve present between the right atrium and the right ventricle is the

- (a) Bicuspid valve
- (b) Tricuspid valve
- (c) Semi-lunar valve
- (d) Mitral valve

Ans :

MAIN 2004

The valve present between the right atrium and the right ventricle is the tricuspid valve. This valve ensures that blood flows from the right atrium to the right ventricle and prevents backflow when the ventricle contracts.

Thus (b) is correct option.

41. Heart sounds are produced due to

- (a) Rushing of blood through valves producing turbulence.
- (b) Closure of tricuspid and bicuspid valves.
- (c) Closure of atrioventricular and semilunar valves.
- (d) Entry of blood into auricles.

DIRECTION : Give appropriate terms for the following :

- 84.** The respiratory pigment contained in human blood.

Ans : MAIN 1996
Hemoglobin

- 85.** The blood vessel that supplies oxygenated blood to liver.

Ans : SQP 1999
Hepatic artery

- 86.** The process by which leucocytes squeeze out through walls of capillaries.

Ans : COMP 2001
Diapedesis

- 87.** The element required for the clotting of blood in man.

Ans : MAIN 2003
Calcium

- 88.** The blood vessel leaving the left ventricle of the mammalian heart.

Ans : SQP 1997
Dorsal Aorta

DIRECTION : Give the Biological / technical term for :

- 89.** The vein which drains the blood from the intestine to the liver.

Ans : COMP 2016
Hepatic portal vein

- 90.** Chemicals found in the blood which act against antigens.

Ans : MAIN 2013
Antibodies

- 91.** Cellular components of blood containing Hemoglobin.

Ans : SQP 2017
Red blood cells/Red blood corpuscles

- 92.** Squeezing out of white blood cells from the capillaries into the surrounding tissues.

Ans : MAIN 2018
Diapedesis

- 93.** The relaxation phase of the heart.

Ans : COMP 2018
Diastole

- 94.** Blood vessels carrying blood to the right atrium.

Ans : SQP 2006
Vena Cava (superior and inferior)

- 95.** The process of engulfing microbes by WBC.

Ans : MAIN 2000
Phagocytosis

- 96.** The largest artery that carries oxygenated blood to the organs.

Ans : COMP 2017
Aorta.

DIRECTION : Name the following :

- 97.** The blood vessel which supplies blood to the liver.

Ans : SQP 2018
Hepatic artery [Hepatic Portal Vein can also be the answer because the type of blood is not specified].

- 98.** Name the mineral essential for clotting of the blood.

Ans : MAIN 2011
Calcium is responsible for clotting of the blood.

- 99.** Name the part of plasma from where fibrinogen is removed.

Ans : COMP 2011
Serum.

- 100.** The vein that carries oxygenated blood.

Ans : MAIN 2015
Pulmonary vein.

- 101.** The vein which carries blood from the kidney.

Ans : SQP 2010
Renal vein

- 102.** A straw coloured fluid connective tissue without RBCs.

Arteries have a thick middle layer composed of smooth muscles and elastic fibers. This structure allows arteries to withstand and regulate the high pressure of blood as it is pumped from the heart to the rest of the body. The elasticity also helps maintain blood flow during diastole (when the heart relaxes).

Thus (b) is correct option.

49. Pulse wave is mainly caused by the
- Systole of the left ventricle
 - Systole of atria
 - Diastole of atria
 - Systole of the right ventricle.

Ans :

SQP 2005

The pulse wave is primarily caused by the systole of the left ventricle. When the left ventricle contracts, it forces blood into the aorta, creating a pressure wave that travels through the arteries, which can be felt as a pulse in areas such as the wrist.

Thus (a) is correct option.

50. When the right atrium contracts, blood flows from the right atrium into the
- Right ventricle
 - Left atrium
 - Pulmonary artery
 - Aorta

Ans :

MAIN 2001

When the right atrium contracts, blood flows into the right ventricle through the tricuspid valve. This is part of the process of deoxygenated blood moving from the body into the heart, eventually being pumped to the lungs for oxygenation.

Thus (a) is correct option.

51. If the blood pressure is measured as $\frac{120}{80}$ mm of Hg, the term 120 refers to
- Heartbeat rate
 - Pulse rate
 - Systolic pressure
 - Diastolic pressure

Ans :

COMP 2000

The 120 in a blood pressure reading (e.g., 120/80 mm Hg) refers to the systolic pressure, which is the pressure in the arteries when the heart's left ventricle contracts and pumps blood into the aorta.

Thus (c) is correct option.

52. SA node is located in
- Upper lateral wall of left atrium
 - Upper lateral wall of right atrium
 - Lower lateral wall of left atrium
 - Lower lateral wall of right atrium

Ans :

MAIN 2010

The SA node (sinoatrial node) is located in the upper lateral wall of the right atrium. It is the natural pacemaker of the heart, responsible for generating the electrical impulses that regulate the heart's rhythm.

Thus (b) is correct option.

53. Angina Pectoris is due to
- Defective nutrition
 - Defective functioning of mitral valve
 - Infection by a virus
 - Chest pain due to inadequate supply of oxygen to the heart muscle

Ans :

SQP 2014

Angina Pectoris is a condition characterized by chest pain due to the inadequate supply of oxygen to the heart muscle. This typically happens when the coronary arteries are narrowed or blocked, reducing the flow of oxygen-rich blood to the heart.

Thus (d) is correct option.

54. A medical student is studying the flow of blood through the heart. During their studies, they learn about the various blood vessels that contribute to the heart's chambers. Which blood vessel is responsible for delivering oxygenated blood into the left atrium?
- Superior vena cava
 - Inferior vena cava
 - Pulmonary vein
 - Pulmonary artery

Ans :

MAIN 2006

Blood is poured into the left atrium through the pulmonary veins, which carry oxygenated blood from the lungs to the heart.

Thus (c) is correct option.

55. In a cardiology lecture, a professor explains that one chamber of the heart has a thick muscular wall to pump blood effectively throughout the body. Which of the following has the thickest wall?
- Right ventricle
 - Right auricle
 - Left ventricle
 - Left auricle

pressure is the pressure exerted on the walls of the arteries when the heart contracts and pumps blood.

Thus (d) is correct option.

- 28.** The opening of right atrium into right ventricle of human heart is guarded by
- Mitral valve
 - Tricuspid valve
 - Pulmonary semilunar valves
 - Bicuspid valve

Ans :

COMP 2005

The opening of the right atrium into the right ventricle is guarded by the tricuspid valve. This valve prevents the backflow of blood from the right ventricle into the right atrium when the ventricle contracts.

Thus (b) is correct option.

- 29.** The left ventricle possesses a thicker wall than right ventricle because
- it receives deoxygenated blood from left atrium.
 - it receives oxygenated blood from left atrium.
 - it pumps oxygenated blood out of the heart.
 - it pumps deoxygenated blood out of the heart.

Ans :

MAIN 2013

The left ventricle possesses a thicker wall than the right ventricle because it pumps oxygenated blood out of the heart to the entire body through the aorta. This requires a greater force compared to the right ventricle, which only pumps blood to the lungs. The thicker muscular wall of the left ventricle enables it to generate the higher pressure needed to circulate blood throughout the body.

Thus (c) is correct option.

- 30.** When a doctor is recording your pulse, he is pressing on your wrist exactly on a
- Artery
 - Capillary
 - Vein
 - Arteriole

Ans :

COMP 2020

When a doctor is recording your pulse, they are pressing on an artery. The pulse is the rhythmic expansion and contraction of the arteries as blood is pumped through them by the heart. The most common place to check the pulse is the radial artery on the wrist.

Thus (a) is correct option.

- 31.** Double circulation means

- Every organ has an artery and a vein.
- Blood flows twice through the heart.
- Oxygenated and deoxygenated blood is separated.
- Both (a) and (b)

Ans :

MAIN 2023

Double circulation refers to the process where blood passes twice through the heart in one complete cycle. First, it goes from the heart to the lungs to get oxygen (pulmonary circulation), and then it returns to the heart and is pumped out to the rest of the body (systemic circulation). This ensures that oxygenated and deoxygenated blood are kept separate for efficient oxygen supply to the body.

Thus (d) is correct option.

- 32.** Bicuspid valve is present between
- Right atrium and right ventricle.
 - Left atrium and right atrium.
 - Right ventricle and left ventricle.
 - Left atrium and left ventricle.

Ans :

SQP 2018

The bicuspid valve, also known as the mitral valve, is located between the left atrium and the left ventricle. It ensures that blood flows in one direction from the left atrium to the left ventricle and prevents the backflow of blood when the left ventricle contracts.

Thus (d) is correct option.

- 33.** Pulse wave is mainly caused by the
- Systole of atria
 - Diastole of atria
 - Systole of the right ventricle
 - Systole of the left ventricle

Ans :

COMP 2016

The pulse wave is mainly caused by the systole of the left ventricle. When the left ventricle contracts during systole, it forces blood into the aorta, creating a pressure wave that travels through the arteries, which is felt as a pulse.

Thus (d) is correct option.

- 34.** The duration of a cardiac cycle is
- 0.6 second
 - 0.7 second
 - 0.9 second
 - 0.8 second

Ans :

MAIN 2002

61. During a medical discussion, a doctor explains that a specific blood vessel is responsible for supplying oxygenated blood to the kidneys for filtration. This blood vessel is the:

(a) Renal artery (b) Renal vein
(c) Dorsal aorta (d) Hepatic vein

Ans :

MAIN 2018

The renal arteries are large blood vessels that carry blood from your heart to your kidneys. Renal is another word for kidney. You have two renal arteries. The right renal artery supplies blood to the right kidney, while the left artery sends blood to the left kidney.

Thus (a) is correct option.

62. During a discussion on blood vessels, a professor mentions that one type of blood vessel has walls made of only a thin layer of endothelium to allow easy exchange of substances. Which one of the following consists of a thin layer of endothelium only?

(a) Arterioles (b) Venules
(c) Valves (d) Capillaries

Ans :

COMP 2009

Capillaries are thin-walled vessels composed of a single endothelial layer. Because of the thin walls of the capillary, the exchange of nutrients and metabolites occurs primarily via diffusion. The arteriolar lumen regulates the flow of blood through the capillaries.

Thus (d) is correct option.

63. A doctor explains that white blood cells defend the body by surrounding and digesting harmful bacteria. This process is called:

(a) Phagocytosis (b) Diapedesis
(c) Active transport (d) Passive transport

Ans :

COMP 2014

White blood cells like neutrophils, monocytes, macrophages, mast cells, dendritic cells etc, defend the body by engulfing pathogens. This process is called phagocytosis.

Thus (a) is correct option.

64. During a study of blood composition, a doctor explains that a particular blood vessel carries the least amount of urea after it has been filtered by the kidneys. Which of the following blood vessels in humans carries the least concentration of urea?

(a) Hepatic vein (b) Hepatic artery
(c) Renal artery (d) Renal vein

Ans :

COMP 2017

Renal vein contains the least amount of urea. Thus (d) is correct option.

65. During a heart examination, the doctor explains that a specific valve between the right atrium and right ventricle ensures blood flows in one direction and prevents backflow. This valve is called:

(a) Mitral valve (b) Bicuspid valve
(c) Semilunar valve (d) Tricuspid valve

Ans :

SQP 2014

The valve that is present between the left atrium and left ventricle of the heart is called the bicuspid or mitral valve.

It consists of two cusps or flaps that prevent the backflow of oxygenated blood from the left ventricle to the left atrium.

Thus (d) is correct option.

66. During a blood transfusion, the doctor explains that one specific blood group can be donated to people of any blood type because it does not contain any antigens that can cause a reaction. Which is the universal donor blood group?

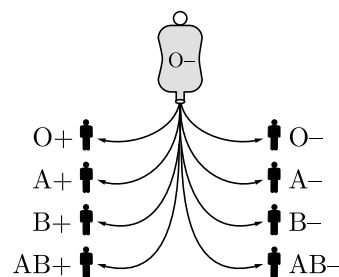
(a) A (b) O
(c) B (d) AB

Ans :

MAIN 2002

O negative donors are often called 'universal donors' because anyone can receive the red blood cells from their donations.

YOU'RE EVERYONE'S TYPE



Thus (b) is correct option.

67. A doctor is examining a patient's pulse during a routine check-up. The doctor notices the pulse rate is slightly elevated and explains that this is due to the heart's pumping action, specifically during the contraction phase. Based on this observation, the pulse wave is mainly caused by:

(a) Systole of the left ventricle
(b) Systole of atria.
(c) Diastole of atria.
(d) Systole of the right ventricle.

Ans :

SQP 2009

Heart sounds are produced due to the closure of the tricuspid and bicuspid (mitral) valves. The first heart sound ("lub") is heard when these atrioventricular valves close during the start of ventricular contraction (systole). This sound results from the vibrations caused by the closing of these valves and the sudden halt of blood flow. Thus (b) is correct option.

42. Left atrium receives oxygenated blood through
 (a) Coronary artery (b) Pulmonary vein
 (c) Pulmonary artery (d) Aorta

Ans :

MAIN 2013

The left atrium receives oxygenated blood from the lungs through the pulmonary veins. These veins carry oxygen-rich blood from the lungs to the left atrium, which then pumps it into the left ventricle to be distributed throughout the body. Thus (b) is correct option.

43. Artery is a blood vessel which carries blood
 (a) Towards the heart
 (b) Away from the heart
 (c) Has deoxygenated blood without exception
 (d) None of these

Ans :

COMP 2010

An artery is a blood vessel that primarily carries blood away from the heart. Most arteries carry oxygenated blood, except for the pulmonary artery, which carries deoxygenated blood to the lungs for oxygenation.

Thus (b) is correct option.

44. Leucocytes are colourless due to
 (a) Lack of water
 (b) lack of Hemoglobin
 (c) Presence of lipid
 (d) Presence of Hemoglobin

Ans :

SQP 2018

Leucocytes (white blood cells) are colourless because they lack Hemoglobin, the pigment responsible for the red color in red blood cells. Leucocytes are involved in the immune response and do not require Hemoglobin for oxygen transport.

Thus (b) is correct option.

45. The nearest organ to which the heart supplies oxygenated blood is
 (a) Stomach (b) Lung
 (c) Intestine (d) Heart itself

Ans :

COMP 2023

The lungs are the nearest organ to which the heart supplies oxygenated blood. Although the heart supplies blood to itself through the coronary arteries, the primary circulation of oxygenated blood goes to the lungs first through the pulmonary circulation before reaching other organs.

Thus (b) is correct option.

46. The opening of right auricle into the right ventricle is guarded by
 (a) Bicuspid valve
 (b) Aortic semi-lunar valve
 (c) Tricuspid valve
 (d) Pulmonary semi-lunar valve

Ans :

SQP 2017

The opening between the right auricle (atrium) and the right ventricle is guarded by the tricuspid valve. This valve ensures one-way flow of blood from the right atrium to the right ventricle and prevents backflow during ventricular contraction. Thus (c) is correct option.

47. Human blood consists of
 (a) Plasma
 (b) Fluid matrix
 (c) Formed elements
 (d) All of these

Ans :

MAIN 2013

Human blood consists of three primary components: plasma, fluid matrix, and formed elements. Plasma is the liquid portion of blood, making up about 55% of its volume, and serves as a medium to transport nutrients, hormones, and waste products throughout the body. The fluid matrix refers to the plasma itself, which helps in maintaining the circulation of blood. The formed elements, which make up the remaining 45%, include red blood cells (RBCs), white blood cells (WBCs), and platelets. These formed elements play crucial roles in oxygen transport, immune defense, and blood clotting, respectively.

Thus (d) is correct option.

48. Which of the following blood vessels has a thick middle layer of smooth muscles and elastic fibres?
 (a) Arterioles
 (b) Arteries
 (c) Veins
 (d) Bone

Ans :

COMP 2008

Ans :

COMP 2011

Red blood cells are biconcave and lack a nucleus, while platelets are involved in the clotting process. Thus (c) is the correct option.

74. Priya tried to match the functions of different types of leucocytes in the human body. She tabulated the pairs as follows:

Leucocyte	Function in the Body
P	Engulfs and destroys microorganisms
Q	Produces antibodies to fight infections

Identify the correct pair of leucocytes.

- (a) P – Neutrophils, Q – Lymphocytes
 (b) P – Monocytes, Q – Eosinophils
 (c) P – Basophils, Q – Monocytes
 (d) P – Lymphocytes, Q – Neutrophils

Ans :

MAIN 2020

Neutrophils are phagocytic cells that engulf microorganisms, while lymphocytes produce antibodies to provide immunity. Thus (a) is the correct option.

75. Priya tried to match the types of blood cells with their production sites. She tabulated the pairs as follows:

Blood Cell	Production Site
P	Produced in the red bone marrow
Q	Produced in lymphoid tissues

Identify the correct pair of blood cells.

- (a) P – Red Blood Cells, Q – White Blood Cells
 (b) P – White Blood Cells, Q – Red Blood Cells
 (c) P – Red Blood Cells, Q – Platelets
 (d) P – White Blood Cells, Q – Platelets

Ans :

SQP 2012

Red blood cells are produced in the red bone marrow, while white blood cells are produced in both the bone marrow and lymphoid tissues. Thus (a) is the correct option.

76. Priya tried to match the blood components with their compositions. She tabulated the pairs as follows:

Blood Cell	Production Site
P	Produced in the red bone marrow
Q	Produced in lymphoid tissues

Identify the correct pair of blood components.

- (a) P – Plasma, Q – Red Blood Cells
 (b) P – Platelets, Q – White Blood Cells
 (c) P – Plasma, Q – Platelets
 (d) P – White Blood Cells, Q – Red Blood Cells

Ans :

MAIN 2015

Plasma consists of water, proteins, and other dissolved substances, while red blood cells contain Hemoglobin and lack a nucleus. Thus (a) is the correct option.

ONE MARK QUESTIONS

DIRECTION : Fill in the blanks :

77. The smallest blood vessels in the human body.

Ans :

SQP 2025

Capillaries

78. The contraction phase of the heart is _____.

Ans :

MAIN 2008

Systole

79. The blood vessel that begins and ends in capillaries is the _____.

Ans :

SQP 2011

Portal vein

80. An artery which supplies blood to the liver is _____.

Ans :

COMP 2003

Hepatic artery

81. SA node is located on the wall of _____.

Ans :

MAIN 2000

Right auricle

82. _____ is universal recipient blood group.

Ans :

COMP 2017

AB

83. Irregular-shaped blood cells are _____.

Ans :

SQP 2023

WBC

Ans :

COMP 2019

The left ventricle has the thickest wall because it needs to pump oxygenated blood with high pressure to all parts of the body through the aorta. This requires stronger contractions compared to the other chambers of the heart.

Thus (c) is correct option.

56. During a heart examination, a doctor explains that a specific node in the heart generates electrical impulses that regulate the heart's rhythm, acting as the natural pacemaker. The pacemaker of the heart is:

- (a) AV node
- (b) SV node
- (c) SA node
- (d) tricuspid valve

Ans :

MAIN 2021

The SA node (sinoatrial node) is known as the pacemaker of the heart because it generates the electrical impulses that initiate each heartbeat. These impulses cause the heart to contract and regulate the heart's rhythm.

Thus (c) is correct option.

57. During a medical discussion, a biology teacher explains that red blood cells must pass through the heart as they move between different parts of the body, including the hepatic artery and the aorta. How many times will a red blood corpuscle pass through the heart in its journey from the hepatic artery to the aorta?

- (a) Only once
- (b) Two times
- (c) Several times
- (d) Four times

Ans :

SQP 2010

A red blood corpuscle will pass through the heart twice in its journey from the hepatic artery to the aorta. This is because it will first pass through the heart when it goes to the lungs for oxygenation (via the right atrium and right ventricle), and then it will pass through the heart again when it returns from the lungs and is pumped out through the aorta (via the left atrium and left ventricle).

Thus (b) is correct option.

58. A doctor explains that a type of agranulocyte is crucial for the body's immune response, as it produces antibodies and helps fight infections. This agranulocyte is:

- (a) Basophils
- (b) Neutrophils
- (c) Lymphocytes
- (d) Eosinophils

Ans :

SQP 2021

Lymphocytes are a type of agranulocyte responsible for the immune response in the body. They play a crucial role in identifying and attacking pathogens like bacteria and viruses. Lymphocytes include T-cells and B-cells, which are essential for adaptive immunity, making them key players in defending the body against infections.

Thus (c) is correct option.

59. During a heart check-up, a doctor explains that one of the heart's chambers is responsible for sending deoxygenated blood to the lungs for oxygenation. This chamber of the heart is:

- (a) Right auricle
- (b) Left ventricle
- (c) Left auricle
- (d) Right ventricle

Ans :

SQP 2004

The right ventricle is the chamber of the heart that sends deoxygenated blood to the lungs via the pulmonary artery for oxygenation. The right side of the heart handles deoxygenated blood, while the left side handles oxygenated blood.

Thus (d) is correct option.

60. During a health lecture, a doctor explains that lymph nodes play a crucial role in the immune system by performing a specific function that helps protect the body from infections. The chief function of lymph nodes is to

- (a) Produce WBCs
- (b) Produce hormones
- (c) Destroy pathogens
- (d) Destroy old RBCs

Ans :

MAIN 2013

The chief function of lymph nodes is to destroy pathogens. Lymph nodes act as filters for the lymphatic fluid, trapping bacteria, viruses, and other harmful microorganisms. They contain immune cells, such as lymphocytes and macrophages, which identify and destroy these pathogens to help protect the body from infections.

Thus (c) is correct option.

- Ans :** COMP 2022
Lymph
- 103.** The valve located at the origin of aorta.
Ans : MAIN 2000
Aortic semi-lunar valve
- 104.** A vein that starts with capillaries and ends in capillaries.
Ans : COMP 2020
Portal vein
- 105.** An artery which carries deoxygenated blood.
Ans : SQP 2004
Pulmonary artery
- 106.** The phase of the cardiac cycle in which the auricle contact.
Ans : MAIN 2023
Atrial diastole
- 107.** The phase of cardiac cycle in which the ventricles relax.
Ans : COMP 2021
Ventricular diastole.
- 108.** The membrane covering the heart.
Ans : SQP 2017
Pericardium
- 109.** The fluid present between the membrane covering of heart.
Ans : MAIN 2014
Pericardial fluid
- 110.** The valve present in between right atrium and right ventricle.
Ans : COMP 2010
Tricuspid valve
- 111.** The blood vessel that brings blood from the body parts to the heart.
Ans : MAIN 2008
Vena cava
- 112.** An artery which carries deoxygenated blood.
Ans : COMP 2005
Pulmonary artery
- 113.** A fluid connective tissue.
Ans : SQP 2003
Blood/Lymph
- 114.** The element needed for blood clotting.
Ans : MAIN 2000
Calcium
- 115.** The minute blood vessels that join arteries and veins.
Ans : COMP 2004
Capillaries
- 116.** An organ that destroys worn out red blood cells.
Ans : SQP 2007
Liver
- 117.** A blood vessel that supplies oxygen to the heart.
Ans : MAIN 2009
Pulmonary vein
- 118.** The blood vessel which has valves in its inner lining.
Ans : SQP 2011
Vein
- 119.** Blood cells, the deficiency of which causes anaemia.
Ans : MAIN 2013
RBCs
- 120.** The smallest blood vessels.
Ans : COMP 2015
Capillaries
- 121.** The category of blood vessels which starts from capillaries and ends in capillaries.
Ans : MAIN 2018
Portal vein
- 122.** The nearest organ to which the heart supplies oxygenated blood.
Ans : MAIN 2020
Liver
- 123.** The vitamin necessary for blood clotting.
Ans : COMP 2023
Vitamin K

and enters the lymphatic capillaries is called lymph. Lymph's flow is unidirectional that is from lymph capillaries to lymphatic vessels and finally into lymphatic duct which opens into the vein.

- 189.** Complete the following table on mammalian blood

Components	Origin	Function	App. No./mm ³	Life span
RBC				
WBC				
Platelets				

Ans :

MAIN 2003

Components	Origin	Function	App. No./mm ³	Life span
RBC	Bone marrow	To carry O ₂ to the body parts	5 million	120 days
WBC	Bone marrow	To fight against microorganisms	7000	10 days
Platelets	Bone marrow	Clotting of blood	2,50,000	2-3 days

DIRECTION : Mention one function for each of the following :

- 190.** Lymphocytes

Ans :

COMP 2021

Produce antibodies

- 191.** Thrombocytes

Ans :

MAIN 2021

Clotting of blood

- 192.** The wall of ventricles is thicker than auricles.

Ans :

COMP 2013

To exert more pressure and to pump blood out of the heart, the ventricles of the heart are thicker walled than auricles.

- 193.** Neutrophils

Ans :

MAIN 2012

Phagocytosis

- 194.** Bicuspid valve

Ans :

SQP 2017

It prevents the reverse flow of blood from the left ventricle into the left auricle.

- 195.** Hemoglobin

Ans :

MAIN 2022

It is the respiratory pigment, helps to carry O₂ to the body parts.

- 196.** Vitamin K

Ans :

SQP 2002

Helps in clotting of blood.

- 197.** Pericardium

Ans :

MAIN 2007

It protects the heart.

- 198.** Semilunar valves

Ans :

SQP 2004

It guards the opening of pulmonary artery and aorta.

- 199.** Lymph

Ans :

MAIN 2010

It transports fatty acids and glycerol. It also protects the body against microorganisms.

- 200.** WBCs

Ans :

COMP 2021

To fight against microorganisms by producing antibodies.

- 201.** Pulmonary artery

Ans :

SQP 2009

To transports deoxygenated blood to the lungs.

- 202.** Fibrinogen

Ans :

MAIN 2004

It is a soluble blood protein needed for blood clotting.

- 203.** RBCs

Ans :

SQP 2009

To transport oxygen to the body parts.

- 204.** Thrombocytes

Ans :

MAIN 2017

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Ans : MAIN 2017

Platelets → Thromboplastin → Thrombin,
→ Fibrinogen → Fibrin.

142. Foetus : Amnion : : Heart : _____

Ans : SQP 2017

Foetus : Amnion : : Heart : Pericardium

143. Capacity of our body to resist diseases.

Ans : COMP 2015

Immunity

144. The fluid portion of blood.

Ans : SQP 2014

Plasma

145. Coronary artery

Ans : MAIN 2011

It supplies oxygenated blood to the walls of heart.

146. WBCs squeeze out through the walls of the capillaries into the tissues.

Ans : COMP 2012

Diapedesis.

DIRECTION : State the exact location :

147. Chordae tendinae.

Ans : SQP 2016

Attach free margins of bicuspid and tricuspid valves with the papillary muscles.

148. Pulmonary semilunar valve.

Ans : MAIN 2018, 2013

Opening of pulmonary artery.

149. Mitral valve.

Ans : SQP 2011

Heart (left atrioventricular aperture of heart).

150. Bicuspid valve/Mitral valve.

Ans : MAIN 2015, 2011

Between the left auricle and left ventricle.

151. Tricuspid valve

Ans : COMP 2014

Between the right atrium and right ventricle.

DIRECTION : Choose the ODD one out from the following terms given and name the CATEGORY to which the others belong : Example : Nose, Tongue, Arm, Eye Answer : Odd Term - Arm, Category - Sense organs

152. Lumen, muscular tissue, connective tissue, pericardium

Ans : SQP 2018

Odd term – Pericardium, Category – Parts of blood vessels

DIRECTION : Give scientific reasons :

153. Give scientific reasons for the Blood flows in arteries in spurts and is under pressure.

Ans : MAIN 2016

Blood flows in arteries is jerky and under pressure because the blood is being pumped in the arteries by the rhythmic beating of the heart.

154. Give scientific reasons for the Mature erythrocytes in humans lack nucleus and mitochondria.

Ans : COMP 2016

Degeneration of nucleus and most of the cell organelles takes place during maturation of mammalian erythrocytes so as to accommodate more Hemoglobin for the transportation of more oxygen.

155. The left ventricle of the heart has a thicker wall than the right ventricle.

Ans : COMP 2017

It has to push the blood to the remotest parts of the body such as toes of the feet so the left ventricle of the heart has thicker wall.

156. Blood flows in arteries in spurts and is under pressure.

Ans : SQP 2011

Arteries have to carry blood to longer distances, therefore blood flows with jerks and is away under pressure.

157. The left ventricle of the heart has a thicker wall than the right ventricle.

Ans : MAIN 2008

Left ventricle has to pump blood to longer distances with high pressure, so the left ventricle

has thicker walls. The right ventricle has to pump blood up to the lungs, so it has thinner walls.

- 158.** Mature erythrocytes in human lack nucleus and mitochondria.

Ans : COMP 2017

Lack of nucleus provides increased surface area for absorbing more oxygen. Lack of mitochondria helps to transport all the oxygen absorbed to the tissues. Mitochondria are the site of cellular respiration.

DIRECTION : Complete the following statements by choosing the correct alternative out of those given in brackets :

- 159.** The wall of the heart is made up of _____.
(Striated muscle/Involuntary muscle/Cardiac muscle)

Ans : MAIN 2001

Cardiac muscle

- 160.** Blood looks red because of the red coloured pigment _____ present in the blood cells.
(Hemocyanin/Haemocoel/Hemoglobin)

Ans : COMP 2002

Hemoglobin

DIRECTION : Write down the difference between the following pairs as indicated within the brackets :

- 161.** Erythrocytes and leucocytes (function)

Ans : SQP 2011

Erythrocytes : Carry and supply oxygen to the body.

Leucocytes : Kill foreign germs and act as scavengers, soldiers of the body.

DIRECTION : Answer the following :

- 162.** What is thrombosis ?

Ans : MAIN 2011

Internal clotting of the blood is known as thrombosis.

- 163.** Difference between RBC and WBC (Shape)

Ans : COMP 2015

RBC : Biconcave disc like in shape

WBC : Amoeboid shape

- 164.** State the main function of the Lymphocytes of blood.

Ans : SQP 2016

Production of antibodies to provide specific immunity.

- 165.** Differentiate LUBB and DUP (names of the valves whose closure produce the sound) on the basis of what is mentioned within bracket.

Ans : COMP 2016

LUBB is produced due to the closure of AV valves whereas DUP is produced due to the closure of semi-lunar valves.

- 166.** Bicuspid valve and Tricuspid valve. (Function).

Ans : MAIN 2013

Bicuspid valve	Tricuspid valve
Prevents the back flow of oxygenated blood from left ventricle to left auricle.	Prevents the back flow of de-oxygenated blood from right ventricle to right auricle.

- 167.** What are the two types of blood circulation in humans ?

Ans : COMP 2021

- (i) Pulmonary circulation
(ii) Systemic circulation

- 168.** Where is heart located?

Ans : SQP 2014

Heart is located in the thoracic cavity in between the two lungs.

- 169.** How is heart protected?

Ans : COMP 2018

It is protected by rib cage, pericardium layer and pericardial fluid.

- 170.** Mention the role of pericardial fluid.

Ans : SQP 2009

It acts as a shock absorber and minimises the friction due to the pumping of the heart.

- 171.** Name the different types of corpuscles in the blood.

Ans :

MAIN 2003

RBCs, WBCs and platelets.

172. Name the valves present in the heart.

Ans :

COMP 2001

Cuspid valves and semilunar valves.

173. What is the function of valves in the heart?

Ans :

SQP 2004

They helps in the unidirectional flow of blood. Thus, prevents the backflow of blood.

174. What are the functions of arteries and veins?

Ans :

MAIN 2010

Arteries carry oxygenated blood while veins carry deoxygenated blood.

175. What are systole and diastole?

Ans :

COMP 2017

Systole is the contraction phase of the heart and diastole is the relaxation phase of the heart.

176. What is serum?

Ans :

SQP 2015

Serum is the plasma from which fibrinogen is removed.

177. What is anaemia?

Ans :

MAIN 2009

It is the condition in which abnormal decrease in the number of RBCs occurs.

178. What is leukemia?

Ans :

COMP 2007

It is the increase in number of WBCs at the cost of RBCs.

179. What is hemophilia?

Ans :

MAIN 2006

It is a hereditary disease in which blood does not clot naturally.

180. Why is circulation of blood in human called double circulation?

Ans :

COMP 2001

Blood flows twice through the heart to complete one circulation. It includes pulmonary circulation and systemic circulation.

181. What is clotting of blood?

Ans :

SQP 2004

When blood comes out of the blood vessels due to an injury, a series of changes takes place that transforms the blood fluid into jelly-like mass. This process is called coagulation or clot formation.

182. Name the soluble protein present in blood plasma responsible for clotting.

Ans :

MAIN 2002

Fibrinogen and prothrombin.

183. What is a portal vein?

Ans :

SQP 2004

A vein which starts from capillaries and ends in capillaries is called portal vein, e.g. hepatic portal vein.

184. What is pulmonary circulation?

Ans :

COMP 2009

Pulmonary artery carries deoxygenated blood from the right ventricle to the lungs. Then from the lungs, pulmonary vein transports oxygenated blood to the left auricle. This circulation is pulmonary circulation.

185. What is tissue fluid?

Ans :

MAIN 2000

Tissue fluid is the fluid filtered by the blood capillaries that are present around the tissue cells.

186. Define systemic circulation.

Ans :

COMP 2005

Aorta transports oxygenated blood from the left ventricle to the body parts, the deoxygenated blood from the body returns to the heart through the vena cavae. This circulation is called systemic circulation.

187. What is Rh-factor?

Ans :

MAIN 2009

Rh-factor depends on the presence of antigens on the surface of RBC. If Rh antigen is present on the RBC of a person, then it is called as Rh+ and if not it is called as Rh .

188. What is lymph?

Ans :

COMP 2007

The tissue fluid filtered from the blood capillaries

Ans : COMP 2018
Oxygen

224. The cell in which oxy Hemoglobin is formed is called_____.

Ans : SQP 2000
RBC

225. The blood vessels which transport blood from the heart to any organ is called_____.

Ans : MAIN 2014
Arteries

226. The blood vessel leaving the left ventricle of the mammalian heart is the_____.

Ans : COMP 2019
Aorta

227. Blood group _____ is universal recipient.

Ans : SQP 2021
AB

228. The normal human blood pressure is _____ mm of Hg.

Ans : COMP 2012
120/80

229. A full heartbeat in human beings takes about _____ second.

Ans : MAIN 2016
0.85

230. The wall of heart is made up of_____.

Ans : SQP 2004
Cardiac muscle

231. _____ is an organ which serves as a blood reservoir during emergency.

Ans : MAIN 2000
Heart

DIRECTION : State whether the following statements are True or False. If false, correct and rewrite the false statements by changing the first or last word only.

232. RBCs are of several kinds.

Ans : COMP 2014

False. WBCs are of several kinds.

233. New RBCs are produced in the heart.

Ans : MAIN 2010
False. New RBC are produced in the bone marrow.

234. Pulmonary vein carries oxygenated blood.

Ans : COMP 2019
True.

235. Mammals have open circulatory system.

Ans : SQP 2023
False. Insects have open circulatory system.

236. Three chambered heart is present in mammals

Ans : MAIN 2012
False. Four chambered heart is present in mammals.

237. Hemoglobin is found in WBC.

Ans : MAIN 2010
False. Hemoglobin is found in RBC.

238. The blood plasma from which fibrinogen has been removed is known as lymph.

Ans : COMP 2017
False. The blood plasma from which fibrinogen has been removed is known serum.

239. The blood vessels which have valves in their inner lining are called veins.

Ans : SQP 2001
True.

240. Systolic pressure indicates the upper limit of Blood Pressure.

Ans : MAIN 2020
True.

241. The blood group *O* is a universal donor.

Ans : COMP 2007
True.

242. Iron is the mineral element responsible for the clotting of blood.

Ans : MAIN 2009
False. Calcium is the mineral element responsible for clotting of the blood.

They help in blood clotting.

205. Tricuspid valve

Ans : COMP 2023

It prevents the reverse flow of blood from the right ventricle into the right auricle.

206. Chordae tendinae

Ans : MAIN 2020

To keep the cuspid valves in position.

207. Vena cava

Ans : SQP 2001

To carry deoxygenated blood from the body parts to the right auricle of the heart.

208. Lymphocytes.

Ans : COMP 2006

Lymphocytes produce antibodies for a particular disease.

209. A matured mammalian erythrocyte lacks nucleus and mitochondria.

Ans : MAIN 2016, 2011

Lack of nucleus provides increased surface area for absorption of more oxygen. Lack of mitochondria helps to transport all the oxygen absorbed to the tissue. Mitochondria are the site of cellular respiration.

DIRECTION : Complete the following statements:

210. In human, heart has _____ chambers.

Ans : SQP 2000

Four

211. The _____ walls are thin while the _____ walls are thick.

Ans : MAIN 2004

Auricular, ventricular

212. The right auriculo-ventricular aperture is guarded by a _____ valve.

Ans : COMP 2017

Tricuspid valve

213. The aorta and pulmonary artery are guarded by _____ valve.

Ans :

COMP 2009

Semilunar

214. The thread-like structures that hold the cuspid valves are _____.

Ans : MAIN 2011

Chordae tendinae

215. The part of the blood from which fibrin is removed _____.

Ans : SQP 2023

Serum

216. The largest artery is called _____.

Ans : COMP 2015

Aorta

217. _____ are the blood corpuscles which destroy microorganisms.

Ans : COMP 2018

WBCs

218. RBCs are _____ shaped.

Ans : SQP 2006

Biconcave

219. The command for the heartbeat starts from _____.

Ans : MAIN 2003

Pacemaker/S-A-N

220. The blood vessel supplying blood to kidney is _____.

Ans : COMP 2001

Renal artery

221. The blood vessel supplying blood to liver is _____.

Ans : MAIN 2014

Hepatic artery

222. The pulse rate of a normal adult human is _____ per minute.

Ans : SQP 2013

72

223. The oxy Hemoglobin decomposes and liberates _____.

261. Coronary thrombosis**Ans :**

COMP 2019

It is a kind of heart attack in which a blood clot is formed in the coronary artery.

262. RBC**Ans :**

MAIN 2010

One of the corpuscles present in blood which contains Hemoglobin (the respiratory pigment) RBC that helps in the transport of O_2 to the body parts.

263. Pulse**Ans :**

SQP 2001

The alternate expansion and contraction of the wall of an artery with each systole and diastole of the left ventricle is called pulse.

DIRECTION : Explain briefly :**264.** Veins have valves in their inner lining while arteries do not have valves.**Ans :**

COMP 2017

To prevent the backflow of blood. Since their lumen is wider so they have valve, while arteries have narrow lumen. Blood in arteries flows with jerks so they do not have valves.

265. The pulmonary artery contains deoxygenated blood.**Ans :**

MAIN 2023

The pulmonary artery arises from the right ventricle which contains deoxygenated blood.

266. Circulatory system is also known as 'transport system'.**Ans :**

COMP 2020

Circulatory system helps in the transport of O_2 , CO_2 , hormones and collects metabolic wastes, etc. from all parts of the body. So, it is also known as 'transport system'.

267. Blood flows in arteries in spurts and is under pressure.**Ans :**

SQP 2016

Arteries have to carry blood to longer distances. So high pressure is needed.

DIRECTION : Distinguish between the following pairs:**268.** Artery and Vein**Ans :**

MAIN 2010

	Artery		Vein
(a)	It has thick muscular wall.	(a)	It has thin muscular wall.
(b)	Valves are absent.	(b)	Valves are present.
(c)	Lumen is narrow.	(c)	Lumen is wider.
(d)	It has an elastic wall.	(d)	It has non-elastic wall.
(e)	It contains oxygenated blood.	(e)	It contains deoxygenated blood.
(f)	It carries blood away from the heart.	(f)	It brings the blood to the heart.
(g)	It does not collapse when empty.	(g)	It collapses when empty.
(h)	Blood flows with jerks under great pressure.	(h)	Blood flows continuously with low pressure.

269. Red blood cell and White blood cell**Ans :**

SQP 2009

	Red Blood Cell		White Blood Cell
(a)	It is biconcave or disc-shaped.	(a)	It is irregular in shape.
(b)	It lacks nucleus.	(b)	Nucleus is present.
(c)	It contains Hemoglobin.	(c)	Hemoglobin is absent.
(d)	It helps in the transport of oxygen.	(d)	It protects our body against microorganisms

270. Blood and Lymph**Ans :**

COMP 2002

243. Pulmonary vein carries blood to the lungs.

Ans : MAIN 2019

False. Pulmonary artery carry blood to the lungs.

244. Vitamin E is needed for blood clotting.

Ans : SQP 2022

False. Vitamin K is needed for blood clotting.

245. Arteries ends in capillaries.

Ans : MAIN 2020

True

246. Fibrinogen is an insoluble protein.

Ans : COMP 2018

False. Fibrinogen is a soluble protein

247. Lymph transport respiratory gases.

Ans : SQP 2010

True

248. Systolic pressure shows the upper limit of blood pressure.

Ans : MAIN 2014

True

249. Pulmonary artery is the largest artery.

Ans : COMP 2002

False. Aorta is the largest artery

250. WBC's can squeeze out of the capillaries.

Ans : MAIN 2007

True

251. Thrombokinase is an enzyme needed for blood clotting.

Ans : SQP 2013

True

DIRECTION : Given below are sets of five terms each. Rewrite the terms in correct order in a logical sequence. Example : Large intestine, Stomach, Mouth, Small intestine, Oesophagus. Mouth → Oesophagus → Stomach → Small intestine → Large intestine

252. Fibrin, Platelets, Thromboplastin, Fibrinogen, Thrombin.

Ans : MAIN 2000

Platelets → Thromboplastin → Thrombin → Fibrinogen → Fibrin.

DIRECTION : Define :

253. Portal vein

Ans : SQP 2017

A vein which starts from capillaries and ends in capillaries is called portal vein. e.g. hepatic portal vein.

254. Double circulation

Ans : MAIN 2017

Blood flows twice in the heart before it completes one full round which includes pulmonary and systemic circulation.

255. Diapedesis

Ans : COMP 2002

The process of WBC squeezing out of capillaries is called diapedesis.

256. Phagocytosis

Ans : SQP 2015

The process of WBC engulfing microorganism is called phagocytosis.

257. Systole

Ans : MAIN 2020

The contraction phase of the heart is called systole.

258. Lymph

Ans : COMP 2014

The filtered blood plasma, which does not contain RCBs is called lymph.

259. Diastole

Ans : MAIN 2009

The relaxation phase of the heart is called diastole.

260. Pulmonary circulation

Ans : SQP 2017

The circulation arising from the right ventricle to the lungs and return back to the left auricle through pulmonary artery and pulmonary vein respectively.

124. A genetic disorder in which blood does not clot.

Ans : SQP 2022
Hemophilia

125. The process by which WBCs engulf bacteria.

Ans : MAIN 2019
Phagocytosis

126. The opening through which the two auricles open into ventricle.

Ans : COMP 2017
Auriculo-ventricular aperture

127. The instrument used for measuring heartbeat.

Ans : SQP 2014
Stethoscope

128. The enzyme essential for blood clotting.

Ans : MAIN 2009
Thrombokinase

129. The site of production of red blood cells in the adult human.

Ans : COMP 2007
Bone marrow

130. The type of blood group in which both A and B antigens are present.

Ans : MAIN 2005
Blood group-AB

131. The process by which leucocytes squeeze out through walls of capillaries.

Ans : SQP 2001
Diapedesis

132. The non-nucleated mature blood cells in mammals.

Ans : SQP 2013
RBCs

133. The respiratory pigment contained in human blood.

Ans : MAIN 2016
Hemoglobin

134. The fluid that transports fatty acid and glycerol.

Ans : COMP 2019

Lymph

135. An unstable bright red compound formed between Hemoglobin and oxygen to carry the oxygen to the body cell.

Ans : SQP 2022
Oxy Hemoglobin

136. The type of blood cells showing amoeboid movement.

Ans : MAIN 2020
WBCs

137. The site of production of RBC in the human embryo.

Ans : COMP 2017
Spleen, Liver

138. A disease in which the number of WBCs increase at the cost of RBCs.

Ans : SQP 2012
Leukaemia.

DIRECTION : Choose between the two options to answer the question specified in the brackets for the following : An example is illustrated below. Example : Corolla or Calyx (Which is the outer whorl ?) Answer : Calyx

139. Blood in the renal artery or renal vein (Which one has more urea?)

Ans : COMP 2013
Blood in renal artery

140. Blood in the pulmonary artery or pulmonary vein (Which one contains less oxy hemoglobin?)

Ans : SQP 2018
Blood in pulmonary artery

DIRECTION : Given below are sets of five terms each. Rewrite the terms in correct order in a logical sequence. Example : Large intestine, Stomach, Mouth, Small intestine, Oesophagus. Answer : Mouth → Oesophagus → Stomach → Small intestine → Large intestine.

141. Fibrin, Platelets, Thromboplastin, Fibrinogen, Thrombin.

	Blood		Lymph
(a)	It is red in colour.	(a)	It is colourless.
(b)	It contains Hemoglobin.	(b)	Hemoglobin is absent.
(c)	It contains all types of corpuscles.	(c)	It contains lymphocytes, erythrocytes are absent.
(d)	It contains more proteins than lymph.	(d)	It does not contain fibrinogen.

271. Auricles and Ventricles

Ans :

MAIN 2006

	Auricles		Ventricles
(a)	These are the receiving chambers	(a)	These are the distributing chambers.
(b)	Walls are thin.	(b)	Walls are thick.
(c)	These are the upper chambers of the heart.	(c)	These are the lower chambers of the heart.

272. Plasma and Serum

Ans :

SQP 2009

	Plasma		Serum
(a)	It is the liquid part of the blood.	(a)	It is the filtered blood plasma.
(b)	It does not contain corpuscles.	(b)	It does not contain corpuscles and fibrinogen.

273. Diastole and Systole

Ans :

COMP 2011

	Diastole		Systole
(a)	It is the relaxation phase of the heart.	(a)	It is the contraction phase of the heart.
(b)	During diastole, blood flows into the body parts.	(b)	During systole, blood circulates through the heart.

274. Bicuspid valve and Tricuspid valve

Ans :

SQP 2017

	Bicuspid Valve		Tricuspid Valve
(a)	It guards the left auriculo-ventricular aperture.	(a)	It guards the right auriculo-ventricular aperture.
(b)	It has two leaf-like flaps.	(b)	It has three leaf-like flaps.

275. Pulmonary circulation and Systemic circulation

Ans :

MAIN 2010

	Pulmonary Circulation		Systemic Circulation
(a)	In this circulation, deoxygenated blood is pumped into the lungs.	(a)	The oxygenated blood is circulated into the body parts.
(b)	The blood coming back to the heart is oxygenated.	(b)	The blood coming back to the heart is deoxygenated.

276. Plasma and Lymph

Ans :

SQP 2014

	Plasma		Lymph
(a)	It is straw coloured.	(a)	It is colourless
(b)	It circulates through blood vessels.	(b)	It circulates through lymph vessels.
(c)	It is the liquid part of blood.	(c)	It is the filtered blood plasma.

277. Pulmonary artery and Pulmonary vein

Ans :

MAIN 2005

	Pulmonary Artery		Pulmonary Vein
(a)	It arises from right ventricle.	(a)	It arises from lungs.
(b)	It carries deoxygenated blood.	(b)	It carries oxygenated blood.

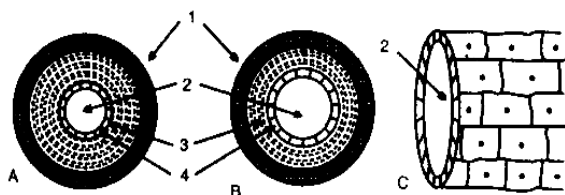
NODIA

- (iii) False. The blood contains an anticoagulant heparin (antithrombin) that prevent clotting of blood within the blood vessels.

FIVE MARKS QUESTIONS

307. The diagrams given below are cross-sections of blood vessels :

- (i) Identify the blood vessels A, B and C.
- (ii) Name the parts labelled 1 to 3.
- (iii) Name the type of blood that flows through A.
- (iv) Mention one structural difference between A and B.
- (v) In which of the above vessels does exchange of gases actually take place?



Ans :

MAIN 2015

- (i) A – Artery
B – Vein
C – Capillary
- (ii) 1 – Tunica externa/External layer
2 – Lumen
3 – Tunica media / middle layer
- (iii) Oxygenated blood
- (iv) The structural difference between A and B are as following :

A		B
Thick walled	–	Thin walled
Narrow lumen	–	Wider lumen
No valves present	–	Valves present
Not collapsible	–	Collapsible
Progressively branched	–	Progressively unite
Smallest artery	–	Smallest vein
breaks into arteriole	–	arises from venules

- (v) C – Capillary

308. How does the circulatory system work to distribute nutrients and oxygen?

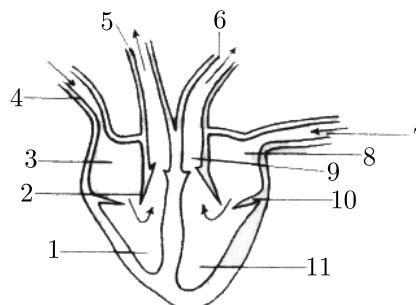
Ans :

SQP 2025

The circulatory system ensures the distribution of nutrients and oxygen to the body through the following steps:

- (i) **Heart as the Pump :** The heart acts as a central pump, propelling oxygenated blood from the lungs and nutrient-rich blood from the digestive system to all parts of the body.
- (ii) **Transport Through Arteries :** Oxygenated blood is transported via arteries, which branch into smaller arterioles and capillaries. These capillaries reach tissues and cells.
- (iii) **Exchange at the Capillary Level :** In the capillaries, oxygen and nutrients diffuse from the blood into body cells. Simultaneously, waste products like carbon dioxide diffuse from cells into the blood.
- (iv) **Return Through Veins :** Deoxygenated blood carrying carbon dioxide and waste products is transported back to the heart through veins and is then pumped to the lungs for oxygenation.
- (v) **Continuous Cycle :** This process repeats continuously, ensuring that every cell in the body receives oxygen and nutrients while removing waste efficiently.

309. Study the diagram carefully and answer the following questions.



- (i) Label the guidelines 1-11.
- (ii) Give one function of parts labelled as 1, 3, 6, 8 and 11.

Ans :

SQP 2011

- (i) 1. Right ventricle 2. Tricuspid valve
3. Right atrium 4. Venacava
5. Pulmonary artery 6. Aorta
7. Pulmonary vein 8. Left atrium
9. Semilunar valve 10. Bicuspid valve
11. Left ventricle

THREE MARKS QUESTIONS

289. Give one point of difference between the following on the basis of what is indicated within brackets :

- Red blood corpuscles and white blood corpuscles (function)
- Blood and Lymph (composition)
- Hemoglobin and Haemocyanin (pigment)

Ans :

SQP 1997, 1996

- RBCs help in transport of oxygen and carbon dioxide. WBCs help in protecting our body against bacteria.
-

Blood	Lymph
Blood has a fluid matrix called plasma and three kind of cells, i.e., RBCs WBCs and platelets. Plasma is colourless and contains a lot of water and many proteins.	Lymph is a light yellow fluid containing lymphocyte cells.

(iii)

	Hemoglobin	Haemocyanin
1.	A red respiratory pigment consisting of haem and the protein globin found in the red blood cells.	A blue respiratory pigment containing copper.
2.	It is found in the blood of vertebrates and a few invertebrates,	It is found in the blood of several invertebrates such as molluscs and crustaceans.

290. How skin and blood help in providing defence mechanisms ?

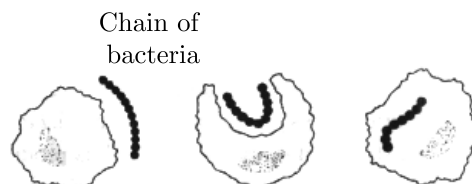
Ans :

COMP 1997

The body defends itself in a number of ways against infection :

- Stomach acid kills microbes in food.
- The skin forms a barrier against bacteria entering the body. If the skin is broken, a blood clot is formed to act as a barrier against bacteria.
- White blood cells produce antitoxins to

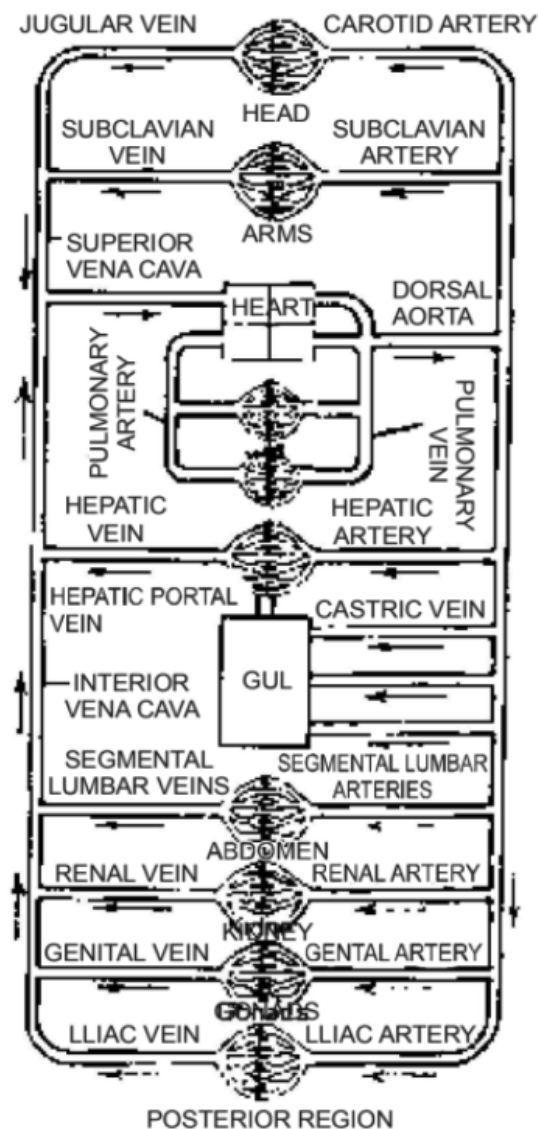
neutralise the toxins (poisons) which are released by infective bacteria. Antibodies are also produced which destroy bacteria. The antibodies stay in the blood for a long time to give built-in resistance (immunity) to a particular disease.



White blood cell

White blood cell engulf and destroy bacteria in our body

291. The diagram given represents the double circulation in human begins.

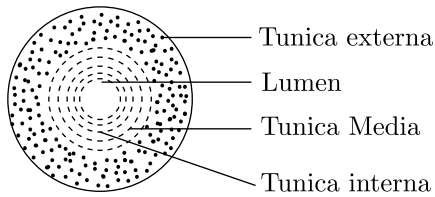


- Name the blood vessels labelled 1, 3, 6, and 7.
- Name the blood vessel that supplies the walls of the heart with oxygen.
- Draw a neat labelled diagram of the blood vessel numbered '2' as seen in a cross-section.
- Mention one structural difference between blood vessels numbered 4 and 5.

Ans :

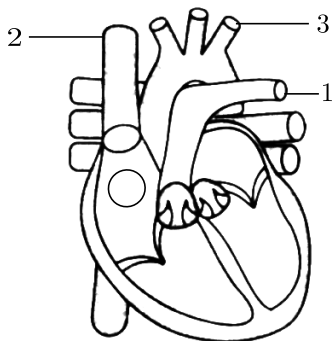
COMP 2013

- Pulmonary vein (3) – Hepatic Portal vein (6)
Hepatic vein (7) Inferior vena cava
- Coronary artery
-



- Arteries are very thick walled with narrow lumen whereas veins are thin walled with wide lumen.

313. The diagram given below represents the human heart in one phase of its functional activities. Study the same and answer the questions that follow :



- Name the phase.
- Label the parts 1, 2, and 3.
- Which part of the heart is contracting in this phase? Give a reason to support your answer.
- Draw well-labelled diagrams of part 1 and 2 to show the structural differences between them.

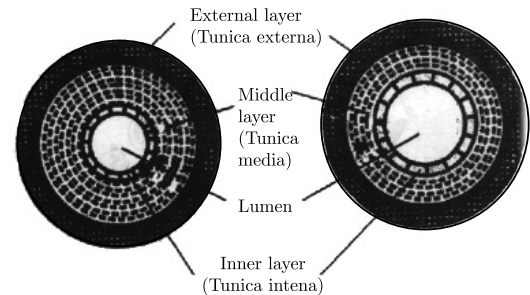
Ans :

MAIN 2013

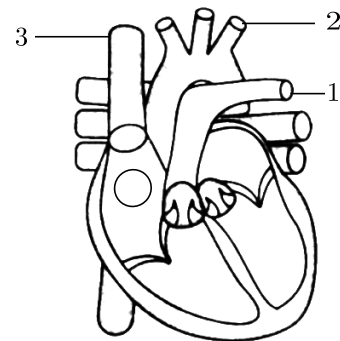
- Auricular systole and ventricular diastole.
1. Pulmonary artery
2. Superior/anterior vena cava
3. Aorta
- Auricles.

Since tricuspid and bicuspid valves are open while pulmonary semilunar valve and aortic semilunar valves are closed.

(iv)



314. The diagram given below represents a section of the human heart. Answer the questions that follow :



- Which parts of heart are in the diastolic phase? Give a reason to support your answer.
- Label the parts numbered 1 and 2 in the diagram. What type of blood flows through them?
- What causes the heart sounds 'TUBB' and 'DUP'?
- Name the blood vessels that supply oxygenated blood to the heart muscles.
- Draw neat labelled diagrams of a cross-section of an artery and a vein.

Ans :

SQP 2017

- Ventricles, as the blood is flowing towards ventricle since tricuspid and bicuspid valves are open.
1. Pulmonary artery
2. Left pulmonary veins.
- The LUBB sound is caused due to the closure of the auriculo-ventricular valves while DUP sound is caused due to the closure of the semilunar valve.
- Coronary arteries supply oxygenated blood to the heart muscles.
-

Ans :

COMP 1997

- (i) **Origin** : Red cells are produced chiefly in the bone marrow of long bones (in adults). Red cells are produced in liver and spleen, also in embryo. Function : RBCs carry oxygen and carbon dioxide. They help to maintain the acid-base balance. They help to maintain the viscosity of blood. Various pigments are derived from Hemoglobin after the disintegration of the red blood cells, e.g., bilirubin, biliverdin, etc.
- (ii) **Location** : Valves are present between left atrium and left ventricle and between right atrium and right ventricle. Function : Valves permit the flow of blood from atrium to ventricle and not in the reverse order.
- (iii) **Origin** : They are produced in the red bone marrow from some giant cells called megakaryocytes. Function : The blood platelets are responsible for the clotting of blood at injuries. Blood platelets on disintegration produce a chemical called thromboplastin that initiates the chain of reactions involved in blood clotting.

296. Write difference between the following pairs :

- (i) Artery, Vein; (ii) Blood, Lymph; (iii) RBC, WBC; (iv) Diastole, Systole; (v) Mitral Valve, Semilunar Valve; (vi) Blood Plasma, Serum; (vii) Lymph, Tissue Fluid; (viii) Pulmonary Circulation, Systemic; (ix) Auricle, Ventricle.

Ans :

MAIN 2002

(i)

	Artery	Vein
1.	Carries oxygenated blood.	Carries deoxygenated blood.
2.	Artery has no valve.	Vein has got valve.
3.	Artery carries blood away from the heart.	Veins carry blood towards heart.
4.	Lumen is narrow in an artery.	Lumen is broad in a vein.
5.	It is deeply seated.	Superficial.

(ii)

	Blood	Lymph
1.	Red in colour.	White or yellowish in colour.

2.	R.B.Cs are present in blood.	R.B.Cs are absent in lymph.
3.	Blood contains more protein.	Lymph contains less protein.
4.	Blood platelets are present.	Blood platelets are absent.

(iii)

	RBC	WBC
1.	Biconcave, circular, non-nucleated.	Irregular in shape or round with nucleus.
2.	Hemoglobin is present.	Hemoglobin is absent.
3.	Produced in red bone marrow.	Produced in red bone marrow, spleen and liver.

(iv)

	Diastole	Systole
1.	Phase of the heart beat cycle when the cardiac muscle is relaxed.	The phase of the heart beat cycle when the cardiac muscle contracts.
2.	Chambers are filled with blood.	Chambers expel the blood from auricles to ventricles, and from ventricles to aorta and pulmonary artery.

(v)

	Mitral Valve	Semi-lunar Valve
1.	It is present between left auricle and left ventricle.	Present between openings of aorta and left ventricle and pulmonary artery and right ventricle.
2.	It consists of a pair of flaps.	It is semi-lunar.

(vi)

	Blood Plasma	Serum
1.	Fibrinogen is present.	Fibrinogen is absent.

(vii)

NODIA

Lymph	Tissue-Fluid
Always travels in Lymphatic vessels.	Never travels in vessels.

(viii)

	Pulmonary Circulation	Systemic
1.	Pumping of blood from right side of heart to lung and back to heart.	Pumping of blood from left side of the heart to rest of the body.
2.	It carries deoxygenated blood.	It carries oxygenated blood.

(ix)

	Auricle	Ventricle
1.	Auricle has thinner walls.	Ventricle has thicker wall.
2.	Auricle receives blood.	It distributes blood.

297. How does lymph flow?**Ans :**

SQP 2017

Lymph flows towards the heart from lymph capillaries into lymphatic vessels and into a lymphatic duct which opens into a larger vein near the heart.

298. How does hepatic portal system helps to reduce burden on the heart?**Ans :**

MAIN 2010

This system provides a short circuit for performing certain important functions (like monitoring glucose level in the blood and detoxifying the blood) before the blood reaches the heart.

299. Why are pulmonary circulation and systemic circulation called so?**Ans :**

SQP 2023

As blood from the right side of the heart reaches the left side through lungs, this part of blood circulation is called pulmonary circulation. Whereas, the blood from the left side of the heart reaches the right side through various systems or body parts, this part of blood circulation is called systemic circulation.

300. How much blood does a human body have? What is meant by agglutination?**Ans :**

COMP 2012

A human body has 5 litres of blood. When two different groups of blood types are mixed, erythrocytes clump together which is termed as agglutination.

301. Point out differences between an artery and a vein.**Ans :**

COMP 2020

The difference between an artery and a vein are as follows:

	Artery		Vein
(i)	Arteries are thick walled.	(i)	Veins are thin walled.
(ii)	Arteries carry blood from the heart to different parts of the body.	(ii)	Veins bring blood from different parts of the body to the heart.
(iii)	The blood flows with jerks as they do not have valves	(iii)	The blood flows smoothly as they have semilunar valves which prevent back flow of blood.
(iv)	Arteries have narrow lumen and are elastic.	(iv)	Veins have wider lumen and are less elastic.
(v)	Arteries are deeply seated and are red in colour.	(v)	Veins are superficial and lie just below the skin. They are greenish-blue in colour.
(vi)	Arteries are non-collapsible.	(vi)	Veins are collapsible.
(vii)	Arteries become empty after death.	(vii)	Veins contain blood even after death.
(viii)	All arteries except pulmonary artery carry oxygenated blood.	(viii)	All veins except pulmonary vein carry deoxygenated blood.

302. What is Plasma ? What are the various functions of Plasma ?

Ans :

SQP 2021

Plasma is a colourless fluid in which blood cells float. It contains mainly water (90%) and dissolved substances (10%). These substances include proteins, fats, mineral salts, glucose, antibodies, urea, hormones and traces of many other substances.

Functions of plasma:

- Transportation of digested food and metabolic wastes.
- Transportation of oxygen and carbon dioxide.
- Transportation of hormones.
- Distribution of body heat and maintaining body temperature.
- Transportation of hormones.
- Maintenance of water level in the cells.
- Maintaining steady state of the body (also called homeostasis).

303. What is the meaning of the term “double circulation”?

Ans :

MAIN 2014

The blood flows twice through the heart and it is called double circulation.

- The blood from all body parts is brought to right auricle which pumps it into right ventricle. From right ventricle blood is pumped to lungs (through pulmonary artery) for oxygenation. [This is first circulation]
- The oxygenated blood from lungs is brought to left auricle which pumps it into left ventricle. From the left ventricle oxygenated blood is distributed to all the parts of the body through largest artery called aorta. [This is second circulation]

304. (i) Write a note on mechanism of blood clotting.
(ii) Show diagrammatically the contraction and relaxation stages of ventricle.

Ans :

COMP 2017

- When blood flows out of a damaged blood vessel, blood platelets release a substance called Thromboplastin. In the presence of calcium and thromboplastin, Prothrombin present in blood gets converted into thrombin. Thrombin then catalyses the conversion of fibrinogen present in plasma into Fibrin. Fibrin is the ultimate product which forms a mesh, into which red blood corpuscles get

entangled and form a Blood Clot.

Given below is a flow chart showing major events in blood coagulation :

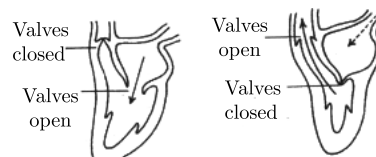
Injured tissues + Blood platelets → Release thromboplastin.

Prothrombin $\xrightarrow{\text{Thromboplastin}}$ Thrombin

Fibrinogen $\xrightarrow{\text{Thrombin}}$ Fibrin.

Fibrin + Red blood corpuscles → Blood Clot.

(ii)



(a) **Ventricle relaxed:** Blood is forced from the atrium into the ventricle. Valves prevent blood flowing 'backwards'

(b) **Ventricle contracted:** Blood is forced from the ventricle and out of the heart. The atrium meanwhile re-fills with more blood

DIRECTION : The first pair indicates the kind of relationship that exists between both the terms.

305. Rewrite and complete the second pair on a similar basis.

- Veins : Superficial :: Artery : _____
- RBC: Round :: WBC: _____
- Artery: Oxygenated blood :: Vein : _____
- Auricles : Receiving chambers :: Ventricles : _____
- Lubb : Atrioventricular valves :: Dub : _____

Ans :

COMP 2004

- Deeply seated
- Irregular
- Deoxygenated blood.
- Distributing chambers.
- Semilunar valves.

306. Mention if the following statements are true or false :

- Average life of a red blood cell in our body is about 120 hours
- The substances which prevent clotting of blood are called coagulants.
- The blood contains an anticoagulant thrombin which prevent clotting of blood within the blood vessels.

Ans :

MAIN 1995

- False. Average life of a red blood cell in our body is 120 days.
- False. They are called anticoagulants.

TWO MARKS QUESTIONS

278. Write any two functions of Lymph.

Ans :

SQP 2025

Absorption of fats from intestines Drains excess tissue fluid into blood Protects body from disease causing germs.

279. Prothronibin, Thrombin, Fibrinogen, Albumin

Ans :

MAIN 2024

Odd One : Albumin

Category : Others are clotting factors.

280. Tonsils, Glomerulus, Spleen, Lymph nodes

Ans :

MAIN 2024

Odd one : Glomerulus

Category : Others are parts of lymphatic system.

281. Mention two structural differences between an artery and a vein.

Ans :

MAIN 2024

Differences between artery and vein:

Artery	Vein
They have thicker walls.	They have thinner walls.
They lack valves.	They contain valves to prevent the backflow of blood.

282. Why are RBCs efficient in their functions though they lack nucleus and mitochondria?

Ans :

MAIN 2024

Loss of nucleus : It makes the red blood cells biconcave thus, increasing their surface area volume ratio for absorbing more oxygen.

lack of mitochondria : This means red cells cannot use oxygen for themselves. Thus, all the oxygen absorbed from the lungs is transported and delivered to the tissues unconsumed.

283. Name the blood vessel which has got the maximum amount of glucose and give reasons for your answer.

Ans :

MAIN 2011

Hepatic portal vein has got the maximum amount of glucose because it connects small intestine (where all carbohydrates are finally converted

into glucose) with liver.

284. A mature mammalian erythrocyte lacks nucleus and mitochondria but is efficient in its functioning. Explain by giving suitable reasons.

Ans :

COMP 2021

Loss of nucleus increases the surface area volume ratio of erythrocytes for absorbing more oxygen. Loss of mitochondria means erythrocytes can't use oxygen for themselves so all oxygen is delivered to the tissues unconsumed.

285. State the main function of the following :

(i) Coronary artery

(ii) Thrombocytes

Ans :

SQP 2011

(i) Blood supply to the heart muscles

(ii) Responsible for the blood clotting.

286. What are the sounds produced during heart beat?

Ans :

COMP 2008

LUBB and DUP are the sounds produced during contraction and relaxation of heart. Lubb is produced by the closure of auricle ventricular valve, soon after ventricular systole begins. The second. i.e., dub which is a short and sharp sound which is produced due to the closure of semi-lunar valve.

287. What is the function of chordae tendineae ?

Ans :

MAIN 2005

Chordae tendineae are delicate, cord-like structures connecting the papillary muscles with the valves of the heart. They prevent blood from leaking back into the atria when the ventricles contract.

288. Give the location and functions of bicuspid and tricuspid valve.

Ans :

SQP 1997

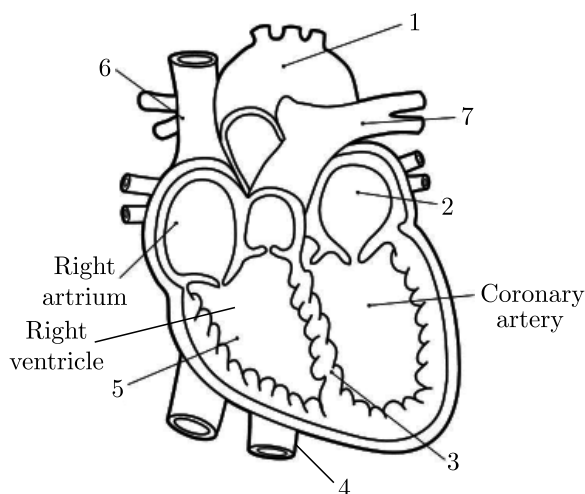
(i) **Bicuspid Valve :** It is also called mitral valve. It consists of two flaps and is situated between the left atrium and left ventricle. It prevents any back flow of blood.

(i) **Tricuspid Valve :** It is a valve consisting of three flaps and is situated between the right atrium and the right ventricle. It also prevents any back flow of blood.

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- (ii) 1. **Right ventricle** : Pumps the blood to the lungs via pulmonary artery.
 3. **Right atrium** : Takes in deoxygenated blood which has been brought from the entire body by main vein.
 6. **Aorta** : Thick-walled main artery which distributes the blood throughout body.
 8. **Left atrium** : Receives oxygenated blood from the lungs via the pulmonary vein.
 11. **Left ventricle** : Pumps the blood under great pressure around the body via the aorta.

310. Given diagram is the external features of the heart :



- (i) Name the parts '1' to '7'.
 (ii) What happens if the coronary artery gets an internal clot?
 (iii) What type of blood does '5' carry?
 (iv) Mention one structural difference between '5' and '4'.

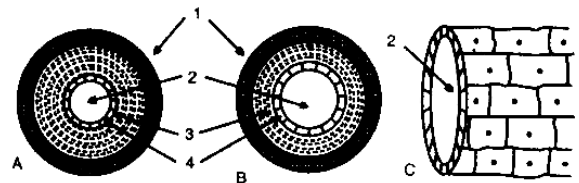
Ans :

COMP 2010

- (i) 1. Aorta 2. Left auricle
 3. Left ventricle 4. Dorsal Aorta
 5. Inferior venacava 6. Superior venacava
 7. Pulmonary arch
 (ii) Coronary artery supply blood to the muscles present in the inner lining of the heart. If it gets an internal clot then blood supply will get stopped to the muscles and they will stop functioning. As a result of this heart will not function.

- (iii) Deoxygenated blood.
 (iv) Inferior vena cava has valves and a wider lumen whereas Dorsal aorta has no valves and a narrow lumen.

311. The diagrams given below are cross sections of blood vessels:



- (i) Identify the blood vessels A, B and C.
 (ii) Name the parts labelled 1 to 3.
 (iii) Name the type of blood that flows through A.
 (iv) Mention one structural difference between A and B.
 (v) In which of the above vessels does exchange of gases actually take place?

Ans :

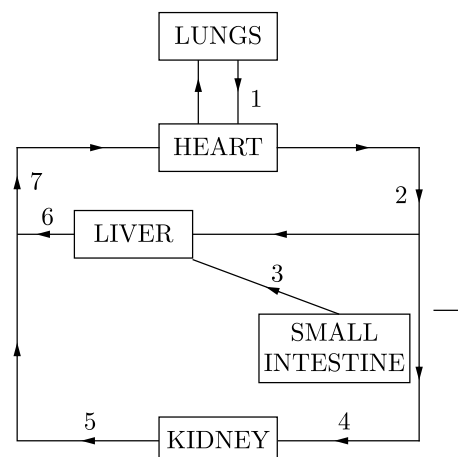
MAIN 2015

- (i) A. Artery B. Vein C. Capillary
 (ii) 1 - Connective tissue
 2 - Lumen
 3 - Muscular wall
 (iii) Oxygenated blood passes through artery.
 (iv)

	Artery	Vein
1.	Muscular wall is thick	Muscular wall is thin
2.	Has a narrow lumen	Has a wider lumen.

- (v) Blood vessel C.(Capillary)

312. The diagram below represents circulation in the human body. Answer the questions that follow :



- (i) Why is it called double circulation ?
- (ii) What is the difference in the composition of blood between pulmonary artery and pulmonary vein ?
- (iii) Rewrite and complete the following sentences by inserting the correct word in the space indicated.

The blood vessel that begins and ends in capillaries is the _____.

Ans :

MAIN 2011

- (i) Blood from right auricle goes to lung, gets purified, enters the left auricle and left ventricles. From heart to lungs and lungs to heart, it is called pulmonary circulation. From heart purified blood passes into whole body. It is called systemic circulation. Pulmonary and systemic together is called double circulation.
- (ii) Pulmonary artery contains deoxygenated blood while pulmonary vein contains oxygenated blood.
- (iii) The blood vessel that begins and ends in capillaries is the Portal veins.

292. Give the composition and functions of blood.

Ans :

SQP 1997

Blood consists of :

- (i) **Red blood cells** : These cells carry oxygen from the capillaries in the lungs to the body cells. The oxygen readily combines with Hemoglobin, a blood pigment in the cell, to make oxyhaemoglobin. The shape of the red blood cell, a biconcave disc, provides a large surface area to absorb as much oxygen as possible and has no nucleus, so allowing more space in the cell.
- (ii) **White blood cells** : These cells protect the body against disease by producing antibodies to kill bacteria.
- (iii) **Plasma** : This is a liquid which carries the blood cells, platelets, dissolved food substances, mineral salts, urea, carbon dioxide, hormones, antibodies and antitoxins.
- (iv) **Platelets** : These help in the clotting of the blood. Functions of blood :

Circulation of blood is responsible for transportation of: (1) nutrients, (2) respiratory gases, (3) waste products, (4) hormones and enzymes, and (5) ions from one part of the body to the other. Blood also plays a role in temperature regulation and protection of the body from the attack of foreign bodies and disease causing pathogens.

293. Explain briefly the idea contained in the following statements :

- (i) Counting pulse is the counting of heartbeat.
- (ii) Capillaries are thin walled.
- (iii) Vitamin K is required, for blood clotting.

Ans :

COMP 1997, 1996

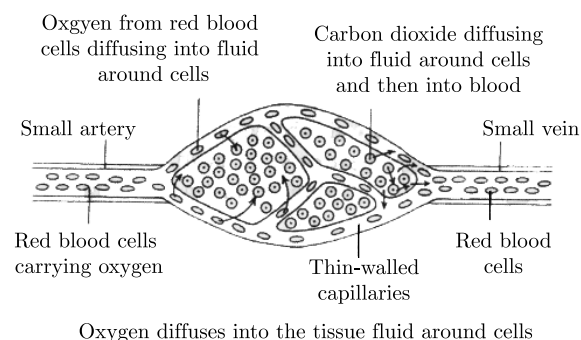
- (i) The beating of the heart is also felt in the arteries as regular jerks called the pulse. The pulse can be felt in any artery that lie near the surface of the body. The radial artery at the wrist is most commonly used for counting pulse. The arteries have elastic muscular walls so they distend every time when blood is forced through them due to the contraction of the heart. Therefore it is said that, "counting of the pulse is indirectly the counting of the heartbeat".
- (ii) With thin walls diffusion takes place more readily and conveniently in capillaries.
- (iii) Vitamin K is essential for the synthesis of prothrombin and fibrinogen proteins by the liver cells. These proteins are essential for the clotting of blood.

294. How oxygen and food from the blood reach the cells ? Explain.

Ans :

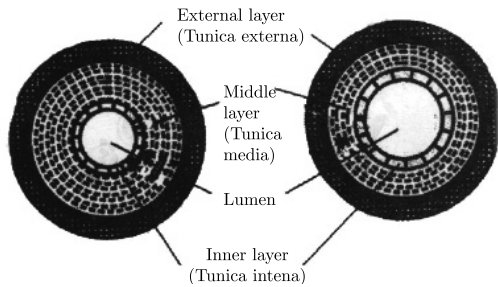
MAIN 1997

- (i) Oxygen and food molecules diffuse out of the blood into the tissue fluid which surrounds every cell.
- (ii) These substances then diffuse into the cell.
- (iii) Waste products diffuse out of the cell into the tissue fluid and into the blood through the walls of the capillaries, to be carried away from the cells to the excretory organs.



295. Write briefly as indicated in the brackets, on the following :

- (i) Red blood corpuscles (origin and function)
- (ii) Valves in the heart (location and function)
- (iii) Blood platelets (origin and function.)



315. Differentiate between vein and capillary.

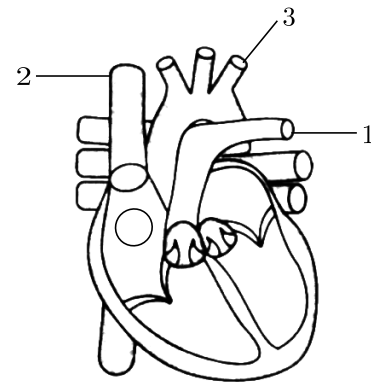
Ans :

MAIN 2011

The difference between vein and capillary are as follows.

	Vein		Capillary
1.	It is a thin walled blood vessel.	1.	It is an extremely narrow blood vessel having very thin walls.
2.	It brings blood from different parts of the body to the heart.	2.	It conveys blood which it receives from a small artery (called arteriole) and gives up to a small vein (called venule). Capillaries form an extensive network throughout all living cells in the body and connect arteries and veins.
3.	It cannot dilate or constrict,	3.	It can dilate or constrict according to the requirement of tissue.
4.	It contains simple valves which permit blood-flow only towards heart (one direction).	4.	It does not contain any valves.
5.	All veins except pulmonary vein carry deoxygenated blood.	5.	Capillaries contain oxygenated blood and are responsible for the exchange of all kind of substances between the blood and tissue fluids.

316. The diagram given below represents the human heart in one phase of its functional activities. Study the same and answer the questions that follow:

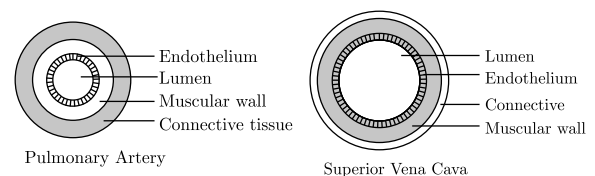


- Name the phase.
- Label the parts 1, 2, and 3.
- Which part of the heart is contracting in this phase? Give a reason to support your answer.
- Draw well labelled diagrams of part 1 and 2 to show the structural differences between them.

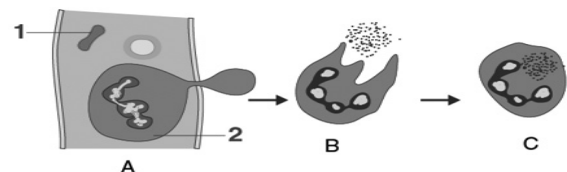
Ans :

COMP 2013

- Atrial systole
1. Pulmonary artery
2. Superior vena cava
3. Aorta
- Auricles are contracting as cuspid valves are opened. Semi-lunar valves are closed.
-



317. Study the following diagram carefully and then answer the questions that follow :



- Name the cell labelled 1.
- Identify the phenomenon occurring in A.
- Mention two structural differences between 1 and 2.

CASE BASED QUESTION

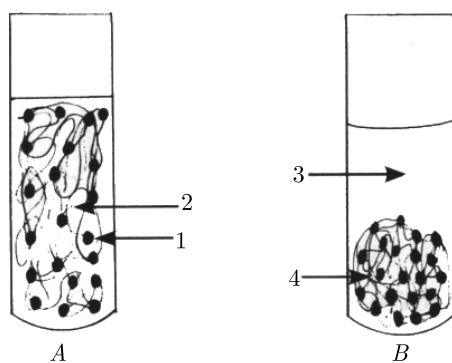
332. Dr. Sharma explains to Mr. Verma how the heart pumps oxygenated blood and how the circulatory system functions. The heart, a vital organ, is responsible for maintaining blood flow throughout the body. It ensures that oxygen and nutrients are delivered to tissues while waste products are removed.

1. What is the primary function of the heart in the circulatory system?
2. Describe the flow of blood through the heart's chambers.
3. Explain the roles of arteries, veins, and capillaries in circulation.
4. What is the significance of a closed circulatory system in vertebrates?

Ans :

1. Pumping
2. Circulation
3. Transport
4. Efficiency

333. In a biology lab, students examine a diagram of blood coagulation. The instructor discusses the components involved in clotting and their roles in preventing excessive bleeding. Students must analyze the figure and answer the following questions.



- (i) Label the parts 1-4.
- (ii) Name the element needed for clotting.
- (iii) Name the chemical which prevents the clotting of blood inside the blood vessels.
- (iv) Briefly explain the process of blood clotting.

Ans :

SQP 2004

- (i) 1 – Corpuscles;
2 – Fibrin threads;
3 – Serum;
4 – Clot

- (ii) Calcium
- (iii) Heparin
- (iv) The platelets release an enzyme in the injured place called thrombokinase. It converts prothrombin into thrombin. In the presence of Ca^{++} , thrombin reacts with fibrinogen to convert it into fibrin. Corpuscles are trapped inside the mesh work of fibrin and form the clot. The clear liquid left out is the serum.

334. During a health check-up, Mr. Verma learns from Dr. Sharma about the components of blood and their vital roles in the body. Blood serves multiple functions, including transporting oxygen and nutrients, removing waste, and providing defense against infections.

1. What are the main components of blood and their functions?
2. How does blood regulate body temperature and pH levels?
3. Discuss the role of Hemoglobin in oxygen transport.
4. How does blood protect the body against infections?

Ans :

1. Cells
2. Homeostasis
3. Binding
4. Immunity

335. Dr. Sharma informs Mr. Verma about lymph nodes and their role in immune response, emphasizing the lymphatic system's function in removing waste. She explains that lymph fluid is essential for transporting immune cells and maintaining fluid balance in the body.

1. What is the role of lymph in the body?
2. Describe the structure and function of lymph nodes.
3. How do lymphatic vessels assist in maintaining fluid balance in the body?
4. What is the importance of lymphocytes in the immune response?

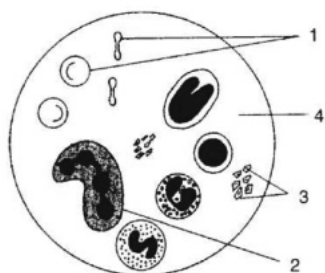
Ans :

1. Drainage
2. Filtering
3. Absorption
4. Defense

336. Dr. Sharma explains to Mr. Verma how blood clotting occurs and the importance of platelets in this process. She highlights the critical steps

- (a) It supplies all essential chemical substances like amino acids, glucose, etc., to the cells of the body which are required for their normal metabolism.
- (b) It transports oxygen to all living cells for tissue respiration.
- (c) It removes carbon dioxide from all cells which are produced during metabolism. The carbon dioxide is removed as bicarbonate which are dissolved in blood plasma.
- (d) It distributes hormones to all parts of the body from the endocrine glands.
- (e) It prevents our body from infections caused by pathogens. WBC acts as phagocytes and engulfs these pathogens and protect us from diseases.
- (f) White blood corpuscles of blood (WBCs) also secrete into the plasma the antibodies which are chemical substances capable of neutralizing toxic substances in blood secreted by the bacteria.
- (g) Blood helps in maintaining normal body temperature.
- (h) It keeps the homeostasis of the tissue fluid, acid base balance and osmoregulation in the body.
- (i) It helps in the formation of clot in the injured tissue. Thus, it prevents further bleeding.
- (j) It removes urea, uric acid and other poisonous substances from liver and throws them into kidney from where they are removed through urine.
- (k) Blood in the arteries is under pressure which helps to support the tissues.

321. Given below is a diagram of a human blood smear. Study the diagram and answer the questions that follow:



- (i) Name the components numbered '1' to '4'.
- (ii) Mention two structural differences between the parts '1' and '2'.
- (iii) Name the soluble protein found in part '4' which forms insoluble threads during clotting of blood.

- (iv) What is the average lifespan of the component numbered '1'?
- (v) Component numbered 1' do not have certain organelles but are very efficient in their function. Explain.

Ans :

SQP 2018

- (i) 1. Red blood cells/Erythrocytes
2. White blood cells/Leucocytes
3. Platelets/Thrombocytes
4. Blood plasma
- (ii) RBC : Don't have nucleus
WBC : Nucleus present
Biconcave disc like Amoeboid in shape
- (iii) Fibrinogen
- (iv) 140 days
- (v) Loss of Nucleus increases their surface area for absorbing more oxygen, loss of mitochondria means RBCs cannot use oxygen for themselves and loss of endoplasmic reticulum increases flexibility of RBCs for their movement through narrow capillaries.

322. Answer the following questions :

- (a) Name the veins which carry pure blood.
- (b) Name an artery which carries impure blood.
- (c) What is a pacemaker ?
- (d) A matured mammalian erythrocyte lacks nucleus and mitochondria. Give reasons.
- (e) How is heart protected from shocks and jerks?
- (f) Why is the wall of the left ventricle the thickest?
- (g) Name the element and protein present in Hemoglobin.
- (h) Name three structures which are present in all living cells but absent in RBC.

Ans :

COMP 2012

- (a) Pulmonary veins.
- (b) Pulmonary artery is the only artery which carries impure blood from right ventricle to the lungs for purification. All other arteries carry pure or oxygenated blood. All veins carry impure blood or deoxygenated blood to the heart except pulmonary vein.
- (c) The pacemaker is the sinoatrial node (SAN) located in the wall of right auricle near the point of entry of the venacava. Impulses for contraction and relaxation of the heart originate in the pacemaker or sinoatrial node.
- (d) The erythrocyte lacks nucleus and mitochondria to make the space for accomodating large quantity of Hemoglobin.

- (iv) Name the process occurring in B and C and state the importance of this process in the human body.

Ans :

SQP 2011

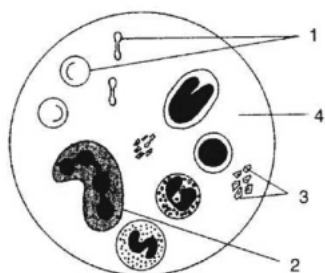
- (i) RBC
(ii) Diapedesis
(iii)

1 – RBC

2 – WBC

- Biconcave or disc-shaped
- Mature RBC does not contain nucleus.
- (iv) Phagocytosis – WBC engulfs microorganisms that enter into the body and acts as the defence system.

- 318.** Given below is a diagram of a human blood smear. Study the diagram and answer the questions that follow :



- (i) Name the components numbered '1' to '4'.
(ii) Mention two structural differences between the parts '1' and '2'.
(iii) Name the soluble protein found in part '4' which forms insoluble threads during clotting of blood.
(iv) What is the average lifespan of the component numbered '1'?
(v) Component numbered 1' do not have certain organelles but are very efficient in their function. Explain.

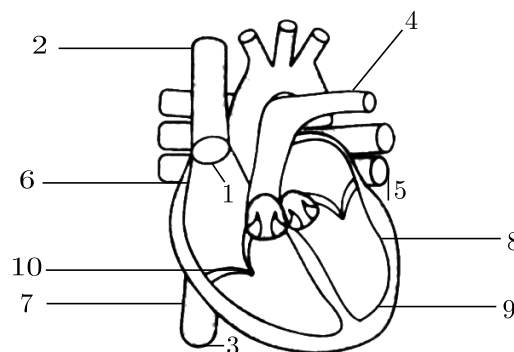
Ans :

MAIN 2018

- (i) 1. Red blood cells/Erythrocytes
2. White blood cells/Leucocytes
3. Platelets/Thrombocytes
4. Blood plasma
(ii) RBC : Don't have nucleus
WBC : Nucleus present
Biconcave disc like Amoeboid in shape.
(iii) Fibrinogen
(iv) 140 days

- (v) Loss of Nucleus increases their surface area for absorbing more oxygen, loss of mitochondria means RBCs cannot use oxygen for themselves and loss of endoplasmic reticulum increases flexibility of RBCs for their movement through narrow capillaries.

- 319.** Given diagram is the longitudinal section of human heart.



- (i) Label the guidelines 1-10.
(ii) Name the place where pacemaker is situated.
(iii) What is the difference in composition of blood in 4 and 5 ?
(iv) How many valves are present in the above diagram?
(v) Name them.

Ans :

COMP 2021

- (i) 1. Aorta
2. Anterior venacava
3. Posterior venacava
4. Left pulmonary artery
5. Pulmonary vein
6. Right auricle
7. Right ventricle
8. Left auricle
9. Left ventricle
10. Tricuspid valve
(ii) In the wall of right auricle.
(iii) The blood vessel 4 has got deoxygenated blood while blood vessel 5 has got oxygenated blood.
(iv) Four.
(v) Bicuspid, tricuspid and two semi-lunar valves.

- 320.** Briefly describe the functions of blood.

Ans :

MAIN 2023

Blood is a liquid connective tissue which is pumped by the heart and flows through the blood vessels like artery, veins and capillaries. It has got the following functions:

- (ii) Based on their structure:
1. Right auricle – Walls are thin
Left ventricle – Walls are thick
Nature of blood:
 2. Right auricle – Deoxygenated blood
Left ventricle – Oxygenated blood
- (iii) Pulmonary circulation
(iv) Aortic semi-lunar valve

325. Comment briefly on the structure and composition of blood in a chart form.

Ans :

SQP 2005

Blood is a viscous complex tissue fluid, red in colour. It is salty in taste, alkaline with pH ranging from 7.3 to 7.5. Blood contains the liquid part called plasma in which solid particles like corpuscles are found suspended but unattached to each other.

- (i) **Plasma** : It is the complex sticky aqueous solution of straw colour which forms 55% of the total volume of the blood. It contains a liquid known as serum and a coagulative substance called fibrinogen. It also contains inorganic and organic substances.

(a) Inorganic substances include chloride, bicarbonates, phosphates and sulphates of sodium, potassium, calcium, magnesium and iron. These are most essential components of blood which help in the normal functioning of the body tissue.

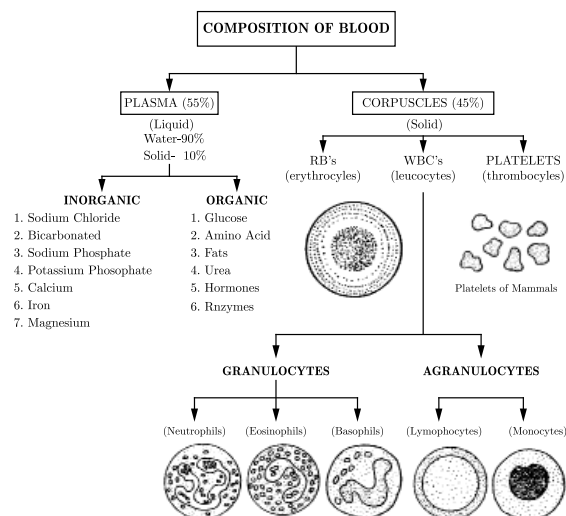
(b) Organic components of plasma include a variety of plasma protein such as fibrinogen, albumins and globulins. Other organic substances include glucose, amino acids, fats, vitamins, hormones, urea, uric acid, etc.

- (ii) **Corpuscles or Blood cells** : 45% of blood constitutes the corpuscles. They are mainly of three types :

(a) **RBCs (Erythrocytes)** : They are red in colour, biconcave and circular without any nucleus, mitochondria and endoplasmic reticulum. They are produced in the bone marrow of bones such as ribs, vertebrae and skull. They contain one iron pigment called Hemoglobin which carry oxygen supply to all living cells for cellular respiration. Their lifespan is 120 days. In addition to their main function, i.e., supplying O_2 to the tissue, they also transport CO_2 from tissues to lungs, maintain the pH of blood, viscosity of blood.

(b) **WBCs (Leucocytes)** : They are colourless, irregular in shape with a nucleus which may be irregular in shape. They are mainly of two types. The first one is granulocytes in which cytoplasm is granular and lobed nucleus while agranulocytes are without granules and nucleus without lobes. Agranulocytes and granulocytes are further subdivided into many other types. The WBCs are produced in the red bone marrow, lymph nodes, spleen and liver. The lifespan of WBCs is usually two weeks. Their main function is phagocytic, i.e., they protect our body from diseases.

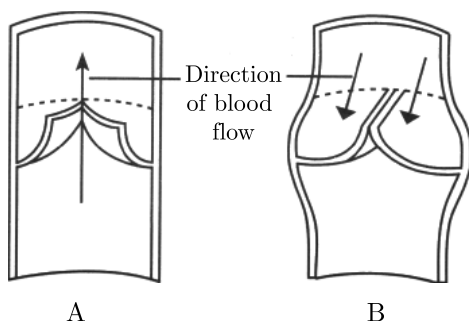
(c) **Platelets (Thrombocytes)** : They are small colourless flat granular corpuscles which are smaller than RBCs. They are present in red bone marrow and contain thromboplastic substance which helps in clotting of blood. The lifespan of platelets is only 2-3 days. They are without nucleus and oval to spherical in shape.



326. The diagram below represents a certain category of blood vessels showing the role of special structure in their walls:

- Name the kind of blood vessels shown.
- Name the structure shown inside the blood vessels.
- Describe the role of these structures.

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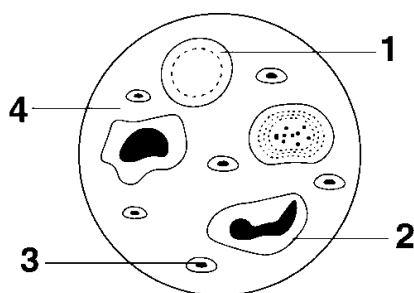
- (iv) Are these structures present in any other kind of blood vessel? If so, name it.
 (v) Towards which side of the figure (top or bottom) is the heart located?

Ans :

SQP 2013

- (i) Veins
 (ii) Valves
 (iii) Blood flowing through the veins is at low pressure and moving against gravity, hence it tends to flow downwards, filling the pocket-shaped valves which close, thereby preventing the backflow of blood.
 (iv) Yes, at the opening of aorta and pulmonary artery.
 (v) Top

321. Given below is a diagram of a smear of human blood. Study the same and then answer the questions that follow:



- (i) Name the parts 1, 2, 3 and 4 indicated by guidelines.
 (ii) Mention two structural differences between the parts labelled '1' and '2'.
 (iii) What is the main function of the parts labelled 1, 2 and 3?
 (iv) What is the life span of the part labelled '1'?
 (v) Name a soluble protein found in '4' which helps in the clotting of blood.
 (vi) Name the disease in which blood fails to clot naturally.

Ans :

MAIN 2009

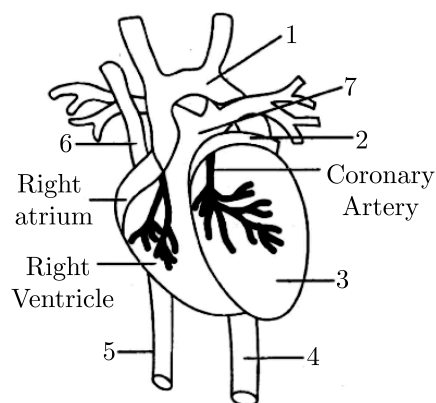
- (i) 1. – RBC; 2. – WBC; 3. – Platelets; 4. – Plasma.

(ii)

	RBC		WBC
(1)	Non-nucleated	(1)	Nucleated
(2)	Biconcave, disc-like	(2)	Irregular in shape

- (iii) 1 - Transports oxygen to all parts of the body.
 2 - Protects the body by destroying harmful microorganisms.
 3 - Clotting of blood.
 (iv) 120 days
 (v) Fibrinogen
 (vi) Hemophilia

328. Given below is a diagram of the external features of the heart.



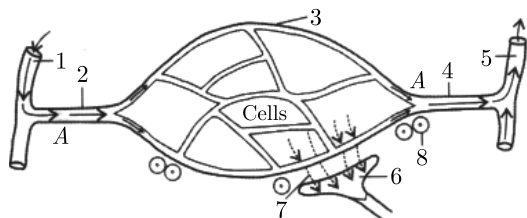
- (i) Name the parts 1 to 7.
 (ii) What happens if the coronary artery gets an internal clot?
 (iii) What type of blood does 5 carry?
 (iv) Mention one structural difference between 5 and 4.

Ans :

MAIN 2017

- (i) 1 - Aorta; 2 - Left atrium; 3 - Left ventricle; 4 - Dorsal aorta; 5 - Inferior vena cava; 6 - Superior vena cava; 7 - Pulmonary artery.
 (ii) If the coronary artery gets a clot the corresponding part of the heart does not get blood supply. It may cause death of the cells of the heart and may cause heart attack.
 (iii) '5' carries deoxygenated blood.
 (iv) '5' is vena cava which has thin muscular walls while '4' is aorta which has thick muscular walls.

329. Given below is a diagrammatic sketch of blood vessels:



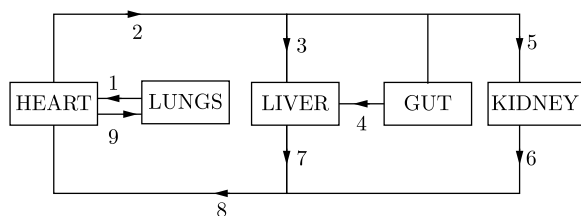
- Label the parts 1 to 8.
- What is the difference in the quality of blood contained in 1 and 5?
- Name any one important component of the blood which remains inside the capillary and fails to move out into the spaces.

Ans :

SQP 2014

- 1 - Artery
2 - Arteriole
3 - Capillary
4 - Venule
5 - Vein
6 - Lymphatic vessel
7 - Lymph
8 - Cell.
- 1 - Artery contains oxygenated blood.
2 - Vein contains deoxygenated blood.
- RBC

330. The following simplified diagram refers to the outline plan of the circulation of blood in a mammal.



- Study the diagram and write the number and name of the blood vessels in each case as mentioned above.
- (a) Several hours after a meal containing a lot of protein, which vessel will contain the highest concentration of urea?
(b) Which vessel would contain the highest concentration of amino acids and glucose soon after a meal?
(c) Which vessel begins and ends in capillaries?

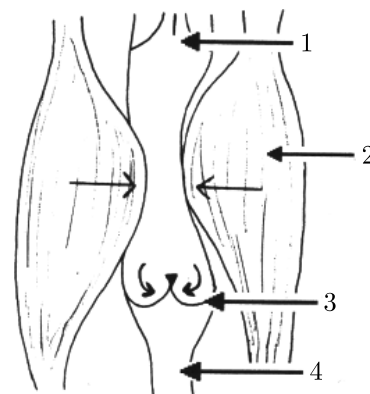
- Which vessel will contain the smallest number of red blood cells per unit volume of blood?
- In which vessel will the blood carry the most oxy Hemoglobin?

Ans :

COMP 2005

- 1 - Pulmonary vein
2 - Aorta
3 - Hepatic artery
4 - Hepatic portal vein
5 - Renal artery
6 - Renal vein
7 - Hepatic vein
8 - Vena cava
9 - Pulmonary artery.
- (a) Renal artery
(b) Hepatic portal vein
(c) Hepatic portal vein
(d) Hepatic vein
(e) Pulmonary vein

331. Given below is the diagram to show the movement of blood in the vein towards the heart:



- Label the parts 1-4.
- How does the structure labelled 4 differ from artery in its location?
- Name the various layers present in the walls of arteries and veins.

Ans :

COMP 2016

1. Open valve
2. Contracting skeletal muscle squeezing the vein
3. Closed valve
4. Vein
- Veins are superficial while arteries are deep seated.
- Tunica externa, tunica media and tunica interna.

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CHAPTER 8

THE EXCRETORY SYSTEM

SUMMARY

1. EXCRETION

Excretion is the elimination of metabolic wastes from the body. The excretory organs maintain constant internal environment required by the body cells by conserving certain substances and by eliminating other metabolic wastes like urea, uric acid, sweat, carbon dioxide and bile pigments. There are four main excretory organs in our body:

- (i) The skin which removes sweat.
- (ii) The lung which removes carbon dioxide and water.
- (iii) Liver excretes cholesterol, bile pigments, and drugs.
- (iv) The kidneys which remove nitrogenous waste materials like urea, uric acid, ammonia, which are produced during protein and nucleic acid metabolism. Removal of excess water from the body is known as osmoregulation. Kidney plays an important role in osmoregulation also. It controls water balance in the body. It also removes excess vitamins, drugs, alcohols and dyes which are not required by the body.

2. NITROGENOUS WASTE PRODUCTS

When animals excrete ammonia, they are called ammonotelic as amphibians and bony fish. When the animals excrete urea they are called ureotelic as sharks, alligators, other mammals and man. Sometimes uric acid is excreted as excretory product. And in animals like insects, land reptiles and birds it is called uricotelism and these animals are called uricotelic.

3. HUMAN EXCRETORY SYSTEM

It consists of a pair of kidneys, a pair of ureters, a urinary bladder and urethra.

- (i) Urethra : It is a canal which extends from the neck of the bladder and leads to exterior.
- (ii) Urinary bladder : A pear-shaped muscular sac-

like structure which store urine temporarily.

3.1 Structure of the Kidney

The structure of the kidney is shown in figure. The functional unit of the kidney is the nephron or kidney tubule. It is important to know the position of the nephrons in relation to the overall plan of the kidney. The outer cortex of the kidney contains the Bowman's capsules and the proximal and distal convoluted tubules, while the medulla houses the loops of Henle and the collecting ducts. Bundles of collecting ducts form Pyramids, which deliver urine into an open space called the pelvis. The ureters connect the kidneys to the bladder.

4. NEPHRONS

Each human kidney possesses about one million of functional and structural units known as nephrons or kidney tubules which has got two main parts.

- (i) Malpighian body (The Bowman's capsule and the glomerulus together are often known as the Malpighian body or renal corpuscle).
- (ii) Renal tubule.

The second part, i.e., the renal tubule is divided into proximal convoluted tubule, loop of Henle and distal convoluted tubule. Nephrons are engaged in three basic processes :

1. Filtering blood,
2. Returning useful substances to blood so that they are not lost from the body, and
3. Removing substances from the blood that are not needed by the body. As a result of these processes, nephrons maintain the homeostasis of blood and urine is produced.

4.1 Parts of Nephron

Each nephron consists of two portions : a renal corpuscle, where plasma is filtered, and a renal tubule into which the filtered fluid passes. Each renal corpuscle has two components: the glomerulus (capillary network) and the glomerular (Bowman's) capsule, a double-walled epithelial cup that surrounds the glomerulus. From the

involved in forming a clot and how this mechanism prevents excessive bleeding during injuries.

1. Describe the process of blood clotting and the role of platelets.
2. What are the steps involved in the formation of a blood clot?
3. How do anticoagulants function in the body?
4. Discuss the significance of Vitamin K in blood clotting.

Ans :

1. Coagulation
2. Cascade
3. Prevention
4. Synthesis

337. Mr. Verma visits Dr. Sharma after experiencing chest pain, and she discusses the implications of heart conditions. She explains that a heart attack can occur if blood flow to the heart muscle is blocked, leading to potential damage.

1. What is a myocardial infarction, and how does it affect the heart?
2. Discuss the symptoms and risk factors associated with heart disease.
3. How can lifestyle changes reduce the risk of heart disorders?
4. What role do diagnostic tests play in identifying heart conditions?

Ans :

1. Blockage
2. Angina
3. Exercise
4. Detection

338. During a health seminar, Dr. Sharma explains the importance of blood types and compatibility during transfusions. She emphasizes the significance of understanding ABO and Rh factors in preventing adverse reactions.

1. What are the different blood groups, and how are they determined?
2. Explain the significance of the Rh factor in blood transfusions.
3. How does blood type compatibility affect the outcome of a transfusion?
4. What precautions should be taken during blood transfusions to prevent agglutination?

Ans :

1. Antigens
2. Compatibility
3. Reactions

4. Matching

339. Dr. Sharma discusses the lymphatic system's importance in immunity and fluid balance with Mr. Verma. She describes how lymph nodes filter lymph fluid and how lymphocytes work to protect the body from infections.

1. How do lymphocytes contribute to the immune response?
2. What is the function of lymph nodes in filtering lymph?
3. Discuss the relationship between the lymphatic and circulatory systems in immune function.
4. What are common disorders associated with the lymphatic system, and how do they affect immunity?

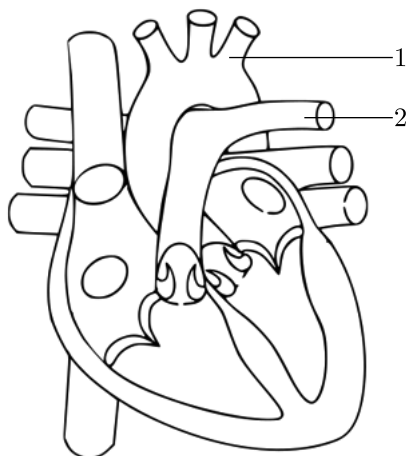
Ans :

1. Antibodies
2. Protection
3. Cooperation
4. Lymphedema

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- (e) The heart is covered by a double membranous layer called pericardium. It is filled with pericardial fluid which protects the heart from shocks and jerks.
- (f) The left ventricle has to pump the blood to a greater distance with great force. That is why it has got the thickest wall compared to the other chambers of the heart.
- (g) The element present in Hemoglobin is iron and protein is globin.
- (h) Nucleus, mitochondria and endoplasmic reticulum are absent in RBC but present in all other cells.

323. The diagram given below represents a section of the human heart. Answer the question that follow:



- (i) Which parts of heart are in the diastolic phase? Give a reason to support your answer.
- (ii) Label the parts numbered 1 and 2 in the diagram. What type of blood flows through them?
- (iii) What causes the heart sounds 'LUBB' and 'DUP'?
- (iv) Name the blood vessels that supply oxygenated blood to the heart muscles.
- (v) Draw neat labelled diagrams of a cross section of an artery and a vein.

Ans :

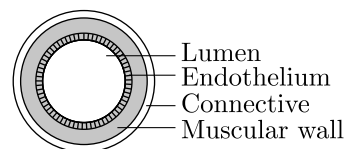
MAIN 2017

- (i) Ventricles.
The reasons are : Cuspid valves are opened, Semi-circular valves are closed and Auricular muscles contract.
- (ii) 1. Pulmonary artery.
2. Pulmonary veins.
Pulmonary artery contains deoxygenated blood while pulmonary veins contain oxygenated blood.

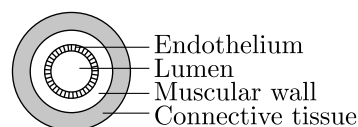
- (iii) LUBB sound is produced when the auricular-ventricular valves get closed at the start of the ventricular systole.

DUP sound is produced when the semi-lunar valves get closed at the start of ventricular diastole.

- (iv) Coronary artery.
- (v)

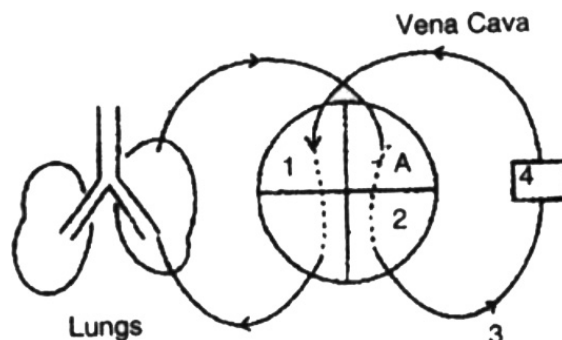


Pulmonary Artery



Pulmonary Vein

324. Given diagram is a schematic representation of the circulatory system in man. Study the same and answer the questions that follow:



- (i) Label the parts 1 to 4 indicated in the diagram.
- (ii) Give one difference between the parts 1 and 2 based on : (1) their structure (2) the nature of blood flowing through them.
- (iii) What is the specific name of the type of blood circulation that takes place between the heart and the lungs?
- (iv) Name the valve found at the beginning of the part labelled 3.

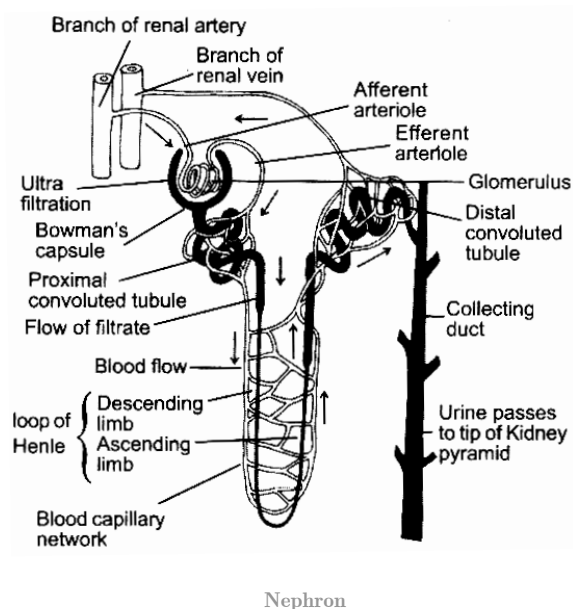
Ans :

COMP 2019

- (i) 1. – Right auricle
2. – Left ventricle
3. – Aorta
4. – Body parts

glomerular capsule, fluid filtered from the plasma passes into the renal tubule, which has three main sections. In the order that fluid passes through them the renal tubule consists of a (1) proximal convoluted tubule. (2) loop of Henle (nephron loop), and (3) distal convoluted tubule.

Proximal denotes the portion of the tubule attached to the glomerular capsule, and distal denotes the portion that is farther away. Convoluted means the tubule is tightly coiled rather than straight. The renal cortex, whereas the loop of Henle extends into the renal medulla, makes a hairpin turn, and then returns to the renal cortex.



The distal convoluted tubules of several nephrons empty into a single collecting duct.

Excretion is the removal of chemical waste from the body, waste that is produced by the metabolic processes within cells and which would be toxic if allowed to accumulate. One should not confuse excretion with egestion or defaecation which is the removal of undigested food and other debris from the intestine.

Different fluids are often compared on the basis of their solute concentrations. A solution that has a higher solute concentration than another is said to be hypertonic. A solution that has a lower solute concentration than another is hypotonic. A solution that has exactly the same solute concentration is isotonic. So, for example, we can say that sea water is hypertonic to human blood plasma, because sea water has a much higher salt concentration.

5. OSMOREGULATION

Kidneys play a role in homeostasis, which is the maintenance of constant internal conditions in the body. The kidneys selectively eliminate water and solutes, such as sodium, potassium and chloride ions, so that the water and solute balance of the body is kept at the correct level. The need to balance the solute concentration of body fluids is called osmotic regulation, or osmoregulation.

6. FUNCTIONS OF KIDNEY

The kidney (particularly its distal tubules) contributes to several vital functions to maintain homeostatic mechanism, such as:

1. Excretion of nitrogenous waste products.
2. Regulation of water balance.
3. Regulation of acid-base balance.
4. Elimination of other substances.
5. Regulation of blood pressure.

About 1.2 litres of urine is produced from 4-6 litres of blood in a normal healthy person per day. The act of urination or micturition is a sort of reflex action. Urine is a transparent, pale yellow fluid acidic in nature. It also contains urea, uric acid, creatinine, sodium chloride, potassium chloride, ammonia and water. Presence of glucose indicates the symptoms of diabetes.

7. FORMATION OF URINE

Urine is produced in nephrons in three different stages:

- (i) Ultrafiltration,
- (ii) Selective reabsorption and
- (iii) Secretion.

When kidney is not working properly water accumulates in the body which is known as dropsy. When urea is not removed from the blood due to improper functioning of the kidney it is called Uremia. When both the kidneys are completely damaged the nitrogenous waste products are removed by dialysis.

7.1 Conduction of Urine

The urine is formed continuously in the uriniferous tubules, from where it passes into the ureters through pelvis. The urine moves down the ureters due to the peristaltic waves in its walls. At the other end the ureters open into the urinary bladder through oblique tunnels. When the urinary bladder is sufficiently full of urine, the free nerve endings in the walls of bladder get stimulated which induce an urge to pass out urine. The sphincter muscle at the neck of the bladder relaxes and a wave of contraction passes into the

bladder, thereby draining the urine out through urethra. Due to oblique passage, the ureters get closed and prevent the back flow of urine into them. The process of passing out urine is called micturition.

MULTIPLE CHOICE QUESTION

- The Loops of Henle lie in
 - Renal Cortex
 - Renal Medulla
 - Renal Pelvis
 - Renal Artery

Ans :

SQP 2025

Thus (b) is correct option.

- A single highly coiled tube where sperms are stored, gets concentrated and mature is known as :
 - Epididymis
 - Vas efferentia
 - Vas deferens
 - Seminiferous tubule

Ans :

MAIN 2015

The epididymis is a highly coiled tube located at the back of the testes where sperms are stored, concentrated, and mature. After being produced in the seminiferous tubules of the testes, immature sperms pass into the epididymis, where they undergo further maturation, gaining motility and the ability to fertilize an egg. This process prepares the sperm for their journey through the vas deferens during ejaculation.

Thus (a) is correct option.

- The nephrons discharge their urine at the :
 - Urinary bladder
 - Urethra
 - Renal pelvis
 - Renal pyramid

Ans :

SQP 2016

The renal pelvis is the funnel-shaped structure in the kidney where urine from the nephrons is collected after being filtered. The urine from the collecting ducts of the nephrons flows into the renal pelvis, which then leads to the ureter, carrying the urine to the urinary bladder for storage.

Thus (c) is correct option.

- The structure that stores urine temporarily is :
 - Ureter
 - Urethra
 - Urinary bladder
 - Kidneys

Ans :

COMP 2021

The urinary bladder is the structure that stores urine temporarily. It is a hollow, muscular organ that collects urine from the kidneys through the ureters and stores it until it is expelled from the body through the urethra during urination.

Thus (c) is correct option.

- The main nitrogenous waste formed in the human body :
 - Uric acid
 - Urea
 - Ammonia
 - Creatinine

Ans :

SQP 2021

Urea is the main nitrogenous waste formed in the human body. It is produced in the liver through the urea cycle as a result of the breakdown of proteins and amino acids. The urea is then transported through the blood to the kidneys, where it is excreted in urine.

Thus (b) is correct option.

- The nephron discharge their urine at the
 - urinary bladder
 - urethra
 - renal pyramid
 - renal pelvis

Ans :

MAIN 2017

The renal pelvis is the part of the kidney where urine from the nephrons is collected. After the filtration process, the urine flows from the collecting ducts of the nephrons into the renal pelvis, which then channels the urine into the ureters, eventually leading to the urinary bladder. Thus (d) is correct option.

- The chief nitrogenous waste in mammals is
 - ammonia
 - uric acid
 - urea
 - amino acids

Ans :

COMP 2015

In mammals, the chief nitrogenous waste product is urea. It is produced in the liver from the breakdown of proteins and amino acids through the urea cycle. Urea is less toxic compared to ammonia and is efficiently excreted by the kidneys in urine.

Thus (c) is correct option.

8. Glomerulus receives the blood through
 (a) efferent arteriole (b) afferent arteriole
 (c) vasa rectae (d) renal vein

Ans :

MAIN 2010

The afferent arteriole carries blood to the glomerulus, a network of capillaries involved in the filtration of blood in the nephron. After filtration, the filtered blood leaves the glomerulus through the efferent arteriole.

Thus (b) is correct option.

9. Maximum amount of water from the glomerular filtrate is absorbed in.
 (a) descending limbs of loop of Henle
 (b) ascending limb of loop of Henle
 (c) proximal convoluted tubule
 (d) distal convoluted tubule

Ans :

SQP 2008

The proximal convoluted tubule (PCT) is responsible for absorbing the maximum amount of water, along with essential nutrients like glucose, amino acids, and ions, from the glomerular filtrate. Approximately 65-70% of the water and solutes are reabsorbed in this part of the nephron. Thus (c) is correct option.

10. Excretion process involves
 (a) removal of nitrogenous waste
 (b) removal of bile pigments
 (c) removal of byproducts of anabolism and catabolism
 (d) All of the above

Ans :

MAIN 2002

Excretion is a process that helps the body remove waste products. It includes the elimination of nitrogenous waste like urea, uric acid, and ammonia, which come from protein metabolism. The excretory system also removes bile pigments produced from the breakdown of hemoglobin, which are eliminated in feces. Additionally, byproducts of anabolism and catabolism are removed, keeping the body's internal environment balanced.

Thus (d) is correct option.

11. Reabsorption of all the glucose and most of the water occurs in
 (a) distal convoluted tubule
 (b) proximal convoluted tubule
 (c) Loop of Henle
 (d) collecting duct

Ans :

SQP 2000

The proximal convoluted tubule (PCT) is where all the glucose and most of the water are reabsorbed from the glomerular filtrate back into the bloodstream. This process ensures that essential nutrients and water are retained by the body while waste products continue through the nephron for excretion.

Thus (b) is correct option.

12. The net pressure gradient that causes fluid to filter out of the glomeruli into the capsule is
 (a) 75 mm Hg
 (b) 20 mm Hg
 (c) 30 mm Hg
 (d) 50 mm Hg

Ans :

COMP 2017

The net filtration pressure that drives the filtration of fluid from the glomeruli into Bowman's capsule is approximately 20 mm Hg. This pressure results from the balance of hydrostatic pressure in the glomerular capillaries, oncotic pressure, and the pressure in Bowman's capsule.

Thus (b) is correct option.

13. On a cool and wet day, people urinate more because of
 (a) the kidney is more active on a wet day
 (b) the uriniferous tubule no longer absorbs water
 (c) reduced rate of sweating
 (d) all of these

Ans :

MAIN 2012

On a cool and wet day, people tend to urinate more because the reduced rate of sweating means less water is lost through the skin. As a result, the kidneys excrete more water through urine to maintain the body's fluid balance.

Thus (c) is correct option.

14. The thin membranous sac serving as the reservoir of urine is
 (a) ureter
 (b) urinary bladder
 (c) glomerulus
 (d) kidney

Ans :

COMP 2016

The urinary bladder is a thin membranous sac that serves as the reservoir for urine. It stores urine until it is ready to be expelled from the body through the urethra.

Thus (b) is correct option.

15. Maximum amount of water from the glomerular filtrate is reabsorbed in
- DCT
 - PCT
 - ascending limb of Henle's loop
 - descending limb of Henle's loop

Ans :

SQP 2020

The proximal convoluted tubule (PCT) is responsible for reabsorbing the maximum amount of water, along with essential nutrients such as glucose and ions, from the glomerular filtrate. Around 65-70% of the filtrate is reabsorbed in this section of the nephron.

Thus (b) is correct option.

16. Glomerular filtrate does not contain
- glucose
 - amino acids
 - hormones
 - proteins

Ans :

MAIN 2023

Glomerular filtrate does not contain large molecules like proteins because they are too large to pass through the filtration membrane of the glomerulus. The filtrate typically contains water, glucose, amino acids, ions, and small waste molecules.

Thus (d) is correct option.

17. More ADH means
- less permeable DCT
 - dilute urine
 - concentrated urine
 - fall in blood osmotic pressure

Ans :

COMP 2021

More ADH (antidiuretic hormone) increases the permeability of the distal convoluted tubule (DCT) and the collecting ducts to water, allowing more water to be reabsorbed back into the bloodstream. This results in concentrated urine and reduced water loss from the body.

Thus (c) is correct option.

18. Diabetes insipidus is caused by the deficiency of hormone
- ADH
 - insulin
 - glucagon
 - oxytocin

Ans :

MAIN 2020

Diabetes insipidus is caused by a deficiency of ADH (antidiuretic hormone), also known as vasopressin. ADH regulates water reabsorption in the kidneys, and its deficiency leads to excessive urine production and thirst.

Thus (a) is correct option.

19. The fluid that is collected in the Bowman's capsule is
- urine
 - a solution of wastes
 - a solution that contains the excretory wastes ready for excretion
 - glomerular filtrate

Ans :

SQP 2018

The fluid that collects in Bowman's capsule is known as glomerular filtrate. This filtrate contains water, ions, glucose, amino acids, and small waste molecules, but no large proteins or blood cells, as they are too large to pass through the filtration barrier.

Thus (d) is correct option.

20. Glomerular filtrate contains
- blood with proteins but without cells
 - plasma without sugars
 - blood without urea
 - blood plasma without blood cells and proteins

Ans :

MAIN 2010

Glomerular filtrate is essentially blood plasma without blood cells and proteins. The filtration process at the glomerulus allows water, ions, glucose, amino acids, and small waste molecules to pass through, but large molecules like proteins and blood cells are too large to be filtered.

Thus (d) is correct option.

21. The nephrons discharge their urine at
- urinary bladder
 - urethra
 - renal pyramid
 - renal pelvis

Ans :

COMP 2006

The nephrons discharge urine into the renal pelvis, which is a funnel-shaped structure in the kidney that collects the urine from the nephrons. From the renal pelvis, urine then flows into the ureter and is transported to the urinary bladder for storage.

Thus (d) is correct option.

22. 'Aquatic animals excrete ammonia'. Which one of the following statements does not support this statement?
- Ammonia is released from the body in gaseous state
 - Ammonia is easily soluble in water
 - Ammonia is highly toxic and needs to be eliminated when formed
 - Ammonia gets converted into less toxic form called urea and uric acid

Ans :

SQP 2002

This is because aquatic animals typically excrete ammonia directly, and the conversion of ammonia into urea or uric acid is characteristic of terrestrial animals like mammals and birds, not aquatic animals.

Thus (a) is correct option.

23. Which one of the following is NOT an excretory activity ?

- (a) Passing out faecal matter
- (b) Sweating
- (c) Removal of urea.
- (d) giving out carbon dioxide

Ans :

MAIN 2019

This is because the passing of faecal matter is a part of the digestive process (egestion), not excretion, which involves the removal of metabolic waste products like urea, carbon dioxide, and sweat from the body.

Thus (d) is correct option.

24. The principal nitrogenous waste in man is

- (a) urea
- (b) uric acid
- (c) ammonia
- (d) nitrogen

Ans :

COMP 2022

Humans primarily excrete urea as the main nitrogenous waste, which is produced in the liver through the urea cycle.

Thus (a) is correct option.

25. The human, urea is formed in the

- (a) ureter
- (b) spleen
- (c) liver
- (d) kidney

Ans :

COMP 2020

The liver is responsible for converting ammonia, a toxic byproduct of protein metabolism, into urea through the urea cycle. This urea is then transported to the kidneys for excretion.

Thus (c) is correct option.

26. Glomerulus is present in

- (a) renal medulla
- (b) renal cortex
- (c) renal pelvis
- (d) renal pyramid

Ans :

SQP 2019

The glomerulus, a network of capillaries where blood filtration begins, is located in the renal cortex of the kidney.

Thus (b) is correct option.

27. Ultrafiltrate generated by the glomerulus is having all the constituents of the blood plasma except

- (a) protein
- (b) WBC
- (c) RBC
- (d) All of these

Ans :

MAIN 2023

Ultrafiltrate generated by the glomerulus contains all the constituents of blood plasma except proteins, white blood cells (WBCs), and red blood cells (RBCs), as these larger components are not filtered through the glomerular membrane.

Thus (c) is correct option.

28. The formation of urine in our excretory system is known as

- (a) uropoiesis
- (b) haemopoiesis
- (c) leucopoiesis
- (d) None of these

Ans :

SQP 2003

Uropoiesis refers to the process of urine formation in the kidneys.

Thus (a) is correct option.

29. Excretion primarily involves

- (a) removal of all byproducts during anabolism
- (b) removal of byproducts during anabolism
- (c) throwing out excess water
- (d) removal of nitrogenous wastes

Ans :

MAIN 2021

Excretion is the biological process by which organisms remove waste products, particularly nitrogenous wastes such as urea, uric acid, and ammonia, that are produced during metabolism. Thus (d) is correct option.

30. Haemodialysis is associated with

- (a) liver
- (b) spleen
- (c) stomach
- (d) kidney

Ans :

COMP 2017

Haemodialysis is a medical procedure used to filter waste products and excess fluids from the blood when the kidneys are not functioning properly. Thus (d) is correct option.

31. Ammonia is converted into urea in

- (a) kidney
- (b) liver
- (c) ureters
- (d) stomach

Ans :

SQP 2004

This conversion occurs through the urea cycle, which detoxifies ammonia produced during protein metabolism. The urea is then transported to the kidneys for excretion.

Thus (b) is correct option.

- 73.** Persons suffering from very low blood pressure pass no urine. Why ?

Ans : MAIN 2010

Ultrafiltration does not take place in persons having low blood pressure. So they do not pass urine due to acute renal failure.

- 74.** What is dialysis ?

Ans : SQP 2009

The process of separating large solute molecules from the small ones by semi-permeable membrane is called dialysis.

- 75.** State why the people with single damaged kidney need not undergo dialysis.

Ans : COMP 2016

One kidney is sufficient to filter out the excretory products. Dialysis is carried out only in case of failure of both the kidneys.

- 76.** Name the structure of the kidney where glomerulus is enclosed.

Ans : MAIN 2020

Bowman's capsule.

- 77.** How is blood brought to Bowman's capsule ?

Ans : SQP 2022

Renal artery carries oxygenated blood along with nitrogenous waste material to the Bowman's capsule.

- 78.** "Urine is formed from alkaline blood but it is acidic in nature". Explain the significance of the above statement.

Ans : COMP 2023

Though blood is alkaline in nature with pH 7.3-7.45 but urine is acidic because many acidic products are continuously added to blood, which the kidney removes by selectively filtering the acidic substances from the blood into the urine.

- 79.** What is dropsy ?

Ans : SQP 2017

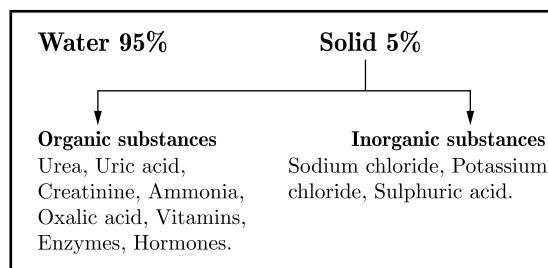
It is a condition in the body when improper functioning of kidney leads to accumulation of water.

- 80.** Write the composition of urine of a man.

Ans :

MAIN 2010

Normal human urine contains the following inorganic and organic substances in water:



- 81.** What is artificial kidney ?

Ans : SQP 2001

It is a dialysis machine which filters waste products from the blood like urea, uric acid which are poisonous and are not removed along with urine due to renal failure.

- 82.** Name two blood vessels which enter and leave kidney.

Ans : MAIN 2005

Renal artery enters the kidney carrying oxygenated blood and urea, uric acid and creatinine, while renal veins leave the kidneys and carry de-oxygenated blood without urea and uric acids which were deposited in the kidneys.

- 83.** Why is right kidney slightly lower in position compared to the left kidney ?

Ans : COMP 2003

To adjust liver in the right side of the abdominal cavity.

- 84.** Name the duct which transports urine from the kidney to the urinary bladder.

Ans : SQP 2007

Ureter.

- 85.** Name the organ in man concerned with maintaining water balance in the body.

Ans : MAIN 2004

Kidney.

- 86.** What is hilus ?

Ans : COMP 2009

The depression present on the concave surface of the kidney is called hilus.

Identify the correct pair of hormones:

- (a) P – Prolactin, Q – Thyroxine.
- (b) P – Oxytocin, Q – Cortisol.
- (c) P – Estrogen, Q – Insulin.
- (d) P – Testosterone, Q – Thyroxine.

Ans :

SQP 2018

Prolactin is responsible for stimulating milk production in the breasts, particularly during and after pregnancy. Thyroxine, produced by the thyroid gland, increases the metabolic rate and energy expenditure in the body.

Thus (a) is correct option.

39. Sita attempted to match the hormones with their effects on the human body.

Hormone	Effect on the Body
P	Regulates blood sugar levels
Q	Promotes the body's response to stress

Identify the correct pair of hormones:

- (a) P – Insulin, Q – Glucagon.
- (b) P – Glucagon, Q – Adrenaline.
- (c) P – Cortisol, Q – Insulin.
- (d) P – Adrenaline, Q – Thyroxine.

Ans :

MAIN 2014

Glucagon is a hormone produced by the pancreas that raises blood sugar levels by promoting the conversion of stored glycogen into glucose. Adrenaline (also known as epinephrine) is produced by the adrenal glands and prepares the body for a 'fight or flight' response, increasing heart rate and energy availability.

Thus (b) is correct option.

40. Vikram tried to match hormones with their roles in the human body.

Hormone	Role in the Body
P	Triggers ovulation
Q	Decreases blood calcium levels

Identify the correct pair of hormones:

- (a) P – Progesterone, Q – Calcitonin.
- (b) P – Luteinizing Hormone, Q – Parathyroid Hormone.
- (c) P – Estrogen, Q – Calcitonin.
- (d) P – Follicle-Stimulating Hormone, Q – Insulin.

Ans :

COMP 2010

Luteinizing Hormone (LH) triggers ovulation by stimulating the release of the egg from the ovary.

Calcitonin is produced by the thyroid gland and helps decrease blood calcium levels by inhibiting osteoclast activity in bones.

Thus (b) is correct option.

41. Neha attempted to match the hormones with their specific actions.

Hormone	Action
P	Stimulates the production of testosterone
Q	Increases water reabsorption in the kidneys

Identify the correct pair of hormones:

- (a) P – Follicle-Stimulating Hormone, Q – Vasopressin.
- (b) P – Testosterone, Q – Aldosterone.
- (c) P – Luteinizing Hormone, Q – Vasopressin.
- (d) P – Estrogen, Q – Cortisol.

Ans :

SQP 2006

Luteinizing Hormone (LH) stimulates the production of testosterone in males by acting on the Leydig cells in the testes. Vasopressin (also known as antidiuretic hormone, ADH) increases water reabsorption in the kidneys by promoting the insertion of aquaporins in the renal tubules, thus concentrating the urine and conserving water.

Thus (c) is correct option.

DIRECTION : Conversation Type Question

42. A biology teacher asked her students to identify two examples of homologous structures in the human body.

Raj said: Forelimbs of humans and whales.

Sonu said: Wings of a bat and feathers of a bird.

Lata said: Tailbone and wisdom teeth.

Abhay said: Pinna and Ossicles.

Who were correct?

- (a) Raj and Lata
- (b) Sonu and Abhay
- (c) Raj and Sonu
- (d) Lata and Abhay

Ans :

MAIN 2002

Raj and Sonu correctly identified homologous structures, as forelimbs of humans and whales share a common ancestry, and wings of bats and birds have similar underlying bone structures.

Thus (c) is correct option.

- 43.** A teacher asked her students to name two examples of endocrine glands in the human body. Raj said: Pancreas and Thyroid. Sonu said: Salivary glands and Sweat glands. Lata said: Adrenal gland and Pituitary gland. Abhay said: Gall bladder and Kidney. Who were correct?
- (a) Raj and Lata
(b) Sonu and Abhay
(c) Lata and Abhay
(d) Raj and Sonu

Ans :

COMP 2017

Raj and Lata correctly named endocrine glands. The pancreas and thyroid are endocrine glands that secrete hormones directly into the bloodstream. Thus (c) is correct option.

- 44.** A biology teacher asked her students to give two examples of inherited traits in humans. Raj said: Eye color and height. Sonu said: Skills and hobbies. Lata said: Blood type and hair color. Abhay said: Pinna and Ossicles. Who were correct?
- (a) Raj and Lata
(b) Sonu and Abhay
(c) Raj and Abhay
(d) Lata and Sonu

Ans :

SQP 2013

Raj and Lata provided examples of inherited traits, as eye color and blood type are determined by genetics. Thus (a) is correct option.

- 45.** A teacher asked her students to list two adaptations in animals for desert survival. Raj said: Cactus and Camels. Sonu said: Polar bear and penguin. Lata said: Kangaroo and Fennec fox. Abhay said: Pinna and Ossicles. Who were correct?
- (a) Raj and Sonu
(b) Lata and Abhay
(c) Raj and Lata
(d) Abhay and Sonu

Ans :

MAIN 2009

Raj and Lata correctly identified adaptations for desert survival, as camels have features to retain water and fennec foxes have large ears to dissipate heat. Thus (c) is correct option.

- 46.** A biology teacher asked her students to provide two examples of behavioral adaptations in animals. Raj said: Hibernation and Migration. Sonu said: Camouflage and Mimicry. Lata said: Web spinning in spiders and Nest building. Abhay said: Pinna and Ossicles. Who were correct?
- (a) Raj and Lata
(b) Sonu and Abhay
(c) Raj and Sonu
(d) Lata and Abhay

Ans :

COMP 2005

Raj and Sonu correctly identified behavioral adaptations; hibernation and migration are behaviors that help animals survive environmental changes. Thus (c) is correct option.

ONE MARK QUESTIONS

DIRECTION : Name the following

- 47.** The main nitrogenous waste in man.

Ans :

SQP 2023

urea

- 48.** Structural and functional unit of the kidney.

Ans :

MAIN 2011

Nephron

- 49.** An organ that produces urea.

Ans :

COMP 2016

Liver

- 50.** Knot like mass of blood capillaries inside the Bowman's capsule.

Ans :

SQP 2013

Glomerulus

- 51.** The organ which produces urea.

Ans :

COMP 2017

Liver

- 52.** The outer region of the kidney.

Ans :

MAIN 2018

cortex

- 53.** The hormone that helps to increase the reabsorption of water from the kidney.

Ans : MAIN 2020
ADH/Vasopressin.

- 54.** The process by which metabolic wastes are removed from the body.

Ans : COMP 2015
Excretion

- 55.** A tuft of blood capillaries found in the Bowman's capsule of nephron.

Ans : SQP 2001
Glomerulus

- 56.** The structure that brings urine from the kidney to the urinary bladder.

Ans : SQP 2019
Ureter

- 57.** Main excretory organ in man.

Ans : MAIN 2013
Kidney

- 58.** The substance found in excess in the urine of a diabetic person.

Ans : COMP 2014
Glucose

- 59.** The blood vessel leaving the kidney.

Ans : SQP 2017
Renal vein

- 60.** The term used for Bowman's capsule and glomerulus together.

Ans : MAIN 2008
Malpighian capsule

- 61.** The thin membranous sac serving as the reservoir of urine.

Ans : MAIN 2004
Urinary bladder

- 62.** An organic waste produced by the lungs in man.

Ans : SQP 2020
Carbon dioxide.

- 63.** The muscle which guards the urethra.

Ans : COMP 2014
Sphincter muscle

- 64.** The process by which kidneys regulate the water content of the body.

Ans : SQP 2015
Osmoregulation

- 65.** The excretory products formed by liver.

Ans : MAIN 2022
Urea, bile (contain pigments)

- 66.** The branch of renal artery which enters into the Bowman's capsule.

Ans : COMP 2004
Afferent arteriole.

- 67.** Name any two organic constituents of normal urine.

Ans : SQP 2000
Urea, creatinine.

- 68.** The blood vessels supplying blood to the kidney.

Ans : MAIN 2004
Renal artery

- 69.** The outer part of the kidney containing the Bowman's capsules.

Ans : SQP 2009
Cortex

- 70.** The form in which glucose is stored in liver.

Ans : COMP 2007
Glycogen

DIRECTION : Answer the following questions :

- 71.** Expand the abbreviation - ADH. Give one example of a diuretic substance.

Ans : SQP 2025
Antidiuretic Hormone
Alcohol, Coconut water, Caffeine, etc.

- 72.** Name two substances found both in urine and sweat.

Ans : SQP 2007
Uric acid and water

32. Which substance is present at a lower concentration in the renal artery than in the renal vein ?

(a) Amino acids (b) Glucose
(c) Carbon dioxide (d) Urea

Ans :

MAIN 2000

The renal vein carries blood away from the kidneys after waste products like urea have been filtered, and it contains more carbon dioxide due to metabolic processes in the kidney. The renal artery, supplying oxygenated blood, has a lower concentration of carbon dioxide.

Thus (c) is correct option.

33. Which of the following statement(s) is/are true?

(a) Urine is hypertonic in distal convoluted tubule
(b) When the urine passes into collecting tubule, it becomes hypotonic
(c) Urine becomes more and more hypotonic as it passes through Henle's loop
(d) Both (a) and (c)

Ans :

COMP 2005

As urine passes through the descending limb of Henle's loop, water is reabsorbed, and it becomes more concentrated (hypertonic). However, in the ascending limb, salts are actively reabsorbed without water, making the urine more hypotonic. Thus (d) is correct option.

34. A patient is undergoing a kidney function test. The doctor mentions that the liquid collected in the Bowman's capsule plays a key role in filtration. Liquid which collects in Bowman's capsule is

(a) water and sulphates
(b) water and glycogen
(c) concentrated urine
(d) plasma minus blood proteins

Ans :

MAIN 2009

The liquid that collects in Bowman's capsule is essentially plasma minus blood proteins. It is a filtrate that includes water, ions, glucose, amino acids, and other small molecules, but large molecules like blood proteins and cells are not filtered through the glomerulus due to their size. Thus (d) is correct option.

35. In a physiology class, Dr. Rao explains how hormones and physiological processes affect urine concentration and volume. A student questions the causes of excessive dilute urination. Excessive dilute urination is because of

(a) increased ADH secretion
(b) increased rate of ultra-filtration
(c) increased sodium level
(d) reduced rate of absorption from filtrate

Ans :

COMP 2018

When the rate of reabsorption from the filtrate is reduced, less water is reabsorbed back into the body, leading to the production of excessive dilute urine.

Thus (a) is correct option.

36. In a lab session, students examine a nephron's structure. The instructor discusses the locations of its various parts, prompting a question about the proximal convoluted tubule. Proximal convoluted tubule of nephron lies in

(a) medulla (b) cortex
(c) ureter (d) None of the above

Ans :

COMP 2010

It is located in the renal cortex, where it is involved in the reabsorption of water, ions, and nutrients from the filtrate.

Thus (b) is correct option.

37. During a practical session, students are studying the anatomy of the nephron. The instructor explains the different segments of the nephron and their locations within the kidney, leading to a question about where the proximal convoluted tubule is found. The proximal convoluted tubule of a nephron is present in

(a) cortex (b) medulla
(c) ureter (d) None of these

Ans :

MAIN 2004

The proximal convoluted tubule is located in the cortex of the kidney, where it plays a role in the reabsorption of water, ions, and nutrients from the filtrate.

Thus (a) is correct option.

DIRECTION : Matching type question :

38. Raj tried to match the hormones with their respective functions in the human body.

Hormone	Function
P	Stimulates milk production in breasts
Q	Increases metabolic rate and energy expenditure

87. Arrange the terms in correct sequence Glomerulus, renal vein, efferent arterioles, renal artery, afferent arterioles, secondary capillaries.

Ans : SQP 2018

Renal artery, afferent arterioles, glomerulus, efferent arterioles, secondary capillaries, renal vein.

88. Which substances are reabsorbed in distal convoluted tubules ?

Ans : MAIN 2021

Water and sodium.

89. State whether the following statements are True or False. If False rewrite the correct form of the statement by changing the first or last word only : Urethra carries urine from kidney to the urinary bladder.

Ans : COMP 2023

Ureter carries urine from kidney to the urinary bladder.

90. What is the total quantity of glomerular filtrate produced by us per day and what does it contain?

Ans : SQP 2011

16 litres of glomerular filtrate we produce per day. It contains Na^+ , K^+ , Ca^{++} , Cl^- hormones, urea, salts in ionic stage, uric acids, glucose, water, amino acids, vitamins.

91. What is the purpose of tubular secretion?

Ans : MAIN 2022

The harmful substances, that are not filtered at the glomerulus are discharged into the urine by tubular secretion.

92. How much urine is secreted by human per day?

Ans : COMP 2017

1.2 litres per day.

93. When does urine become hypotonic and hypertonic?

Ans : SQP 2002

When water intake is high, urine secreted is hypotonic to get rid of excess water from the body. When body has less amount of water, body reabsorbs water and urine then it becomes hypertonic.

DIRECTION : Give the biological/technical term for the following :

94. Pigment providing colour to urine.

Ans : COMP 2016

Urochrome

95. The removal of nitrogenous wastes from the body.

Ans : MAIN 2016

Excretion

DIRECTION : Correct the following statement by changing the underlined word :

96. Normal pale yellow colour of the urine is due to the presence of the pigment Melanin.

Ans : COMP 2018

Urochrome

DIRECTION : State the exact location :

97. Proximal convoluted tubule.

Ans : SQP 2016

Near the Bowman's capsule in the cortex of kidney.

DIRECTION : Complete the following :

98. The U-shaped portion of the nephron is _____.

Ans : MAIN 2010

Loop of Henle

99. Most of the glucose is absorbed in _____ part of nephron.

Ans : SQP 2004

proximal convoluted tubule

100. The organ where urea is produced is _____.

Ans : COMP 2019

liver

101. _____ hormone increases the reabsorption of water from the kidney tubule.

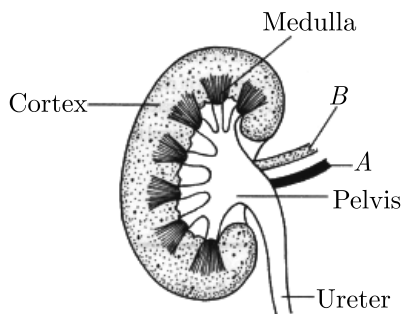
Ans : SQP 2009

ADH

contain them.

(v) Sugar

- 161.** Given below is a simple diagram of the human kidney cut open longitudinally. Answer the following questions :



- Give the definition of excretion.
- Name the units of the kidney.
- Why does the cortex of the kidney show a 'dotted' appearance ?
- Mention two functions of the kidney
- Write two differences in the composition of the blood flowing through blood vessels A and B.
- Name the outer part of the kidney containing the Bowman's capsules.

Ans :

MAIN 2016

- Excretion is defined as the process of elimination of unwanted or even toxic by-products of metabolism from the body.
- Nephrons/uriniferous tubules.
- Because of the presence of Malpighian bodies.
1. Osmoregulation.
2. Removal and excretion of urea from the blood.
-

No.	Renal vein (A)	Renal artery (B)
1.	It contains less urea.	It contains more urea.
2.	It contains less oxygen.	It contains more oxygen.
3.	It contains more carbon dioxide.	It contains less carbon dioxide.

(vi) Cortex.

- 162.** (i) Where is urine carried through the ureters ?
(ii) What is urethra ?
(iii) What happens to glucose which enters the nephron along with the filtrate ?
(iv) How excretion different from osmore-

gulation?

- Which is the major nitrogenous waste product in a human being ? How is it removed from the body ?
- Name the procedure used in the working of an artificial kidney.

Ans :

SQP 2004

- Ureters carry the urine into the urinary bladder where it is stored till it is thrown out of the body.
- It is a duct which carries urine from the urinary bladder to the exterior.
- Glucose is reabsorbed by blood capillaries surrounding the nephron.
- Excretion is the removal of toxic wastes from the body while Osmoregulation is the process of maintaining the right amount of water and proper ionic balance in the body.
- Major nitrogenous waste product in a human being is urea. This urea is dissolved in water and is removed from the body in the form of urine.
- The procedure used in the working of an artificial kidney is called dialysis.

- 163.** (i) What is osmoregulation ? How does it take place in humans ?
(ii) Briefly describe the mechanism of urine formation.
(iii) State the vital functions of the human kidney.

Ans :

COMP 2001

- Osmoregulation is the process of regulating water content and ion concentration in the body of an organism is called osmoregulation. Process of osmoregulation in human beings Osmoregulation is related to the habitat of an organism. In human beings, this function is performed by the kidneys. Kidneys have filtering units called nephrons which not only remove toxic wastes but also help in the reabsorption of useful products into the blood capillaries which surround the nephron. In this way kidneys remove toxic waste and also control water balance and levels of mineral ions in the body.
- Each kidney is made of excretory units called nephrons. The waste material is brought to kidneys by the renal arteries. Blood is filtered (from the blood capillaries) into Bowman's capsule. As this filtrate passes through the tubular parts of nephron, useful products, such as glucose, amino acids are reabsorbed

- 118.** Nitrogenous wastes are formed by the breakdown of fat.

Ans : MAIN 2013

False. Nitrogenous wastes are formed by the breakdown of protein.

- 119.** Ureters bring urine from urinary bladder to outside the body.

Ans : SQP 2014

False. Urethra bring urine from urinary bladder to outside the body.

- 120.** Renal artery carries blood to the kidney.

Ans : MAIN 2023

True.

- 121.** Afferent arteriole is narrower than efferent arteriole.

Ans : COMP 2005

False. Afferent arteriole is broader than efferent arteriole.

- 122.** Glomerulus helps in reabsorption.

Ans : SQP 2003

False. Glomerulus helps in ultrafiltration.

- 123.** Glomerular filtrate contains glucose.

Ans : MAIN 2007

True.

- 124.** Urea is formed in the kidney.

Ans : COMP 2009

False. Urea is formed in the liver.

- 125.** Renal vein contains less urea.

Ans : SQP 2021

True.

- 126.** Urethra carries urine from kidney to the urinary bladder.

Ans : MAIN 2019

False. Ureter carries urine from kidney to the urinary bladder.

DIRECTION : State the role of the following:

- 127.** Renal vein

Ans :

COMP 2017

It collects filtered and deoxygenated blood.

- 128.** Henle's loop

Ans : SQP 2007

It helps in the reabsorption of water and sodium ions.

- 129.** Ureter

Ans : MAIN 2010

It transports urine from kidney to the urinary bladder.

- 130.** Urethra

Ans : SQP 2004

To transport urine from urinary bladder to the exterior.

- 131.** Kidney

Ans : SQP 2002

Formation of urine and osmoregulation.

DIRECTION : In the following case, pick out one term which includes all the three:

- 132.** Glomerular filtrate, Bowman's capsule, Ultrafiltration, Glomerulus.

Ans : COMP 2001

Ultrafiltration

DIRECTION : Given below is a set of five terms.

Rewrite the terms in the correct order so as to be in logical sequence, One has been done for you. e.g., Arterioles, vein, artery, capillaries, venule **Ans. — Artery → arterioles → capillaries → venules → vein**

- 133.** Afferent arteriole, renal vein, capillary network, glomerulus, efferent arteriole

Ans : MAIN 2012

Afferent arteriole → glomerulus → efferent arteriole → capillary network → renal vein.

DIRECTION : Give reasons for the following:

- 134.** As a result of ultrafiltration alongwith excretory products certain useful products like glucose, salt, etc. are also filtered but these are not excreted.

Ans :

SQP 2000

Glucose, salt, etc. in the glomerular filtrate are reabsorbed in the proximal part of renal tubules.

- 135.** Glucose is absent in the urine of a healthy person.

Ans :

COMP 2019

Glucose is reabsorbed into the blood stream in the proximal part of the nephron. So, a normal healthy person's urine is devoid of glucose.

- 136.** There is frequent urination in winter than in summer.

Ans :

SQP 2023

In winter, sweating is less, so more water is given out in the form of urine. Reverse process happens in summer

- 137.** All living things must excrete.

Ans :

MAIN 2020

Metabolic activities of all living things produce nitrogenous waste materials. These waste materials, if accumulated in the body, become poisonous and destroy the vital organs. So, excretion is a must.

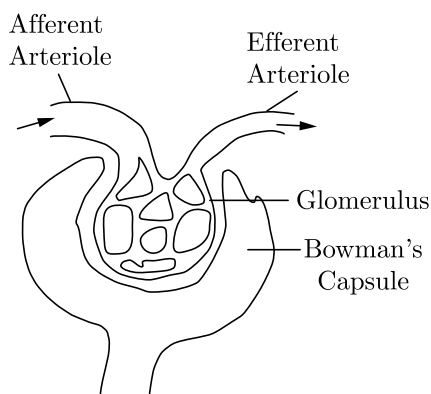
TWO MARKS QUESTIONS

- 138.** Draw a neat, labelled diagram of a Malpighian Capsule.

Ans :

SQP 2025

Diagram of Malpighian capsule



- 139.** Define the term Ultrafiltration.

Ans :

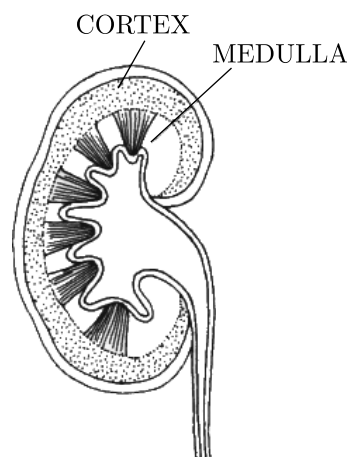
MAIN 2024

Ultrafiltration is a process of filtration of blood in the glomerulus during which the liquid part of the blood such as urea, glucose, amino acids and other substances enter the renal tubule and large molecules remain in the glomerulus which are carried away by efferent arteriole.

- 140.** Draw a neat diagram of a longitudinal section of a human kidney and label Renal Cortex and Renal Medulla on the diagram.

Ans :

MAIN 2021



- 141.** State the difference between the following on the basis of what is given in the brackets.

- (a) Urea and urine (place of occurrence)
(b) Bowman's capsule and malpighian capsule (parts included)

Ans :

MAIN 2013

- (a) Urea is formed in liver.
Urine is formed in kidney.
(b) Bowman's capsule contains glomerular filtrate.
Malpighian capsule – Contains Bowman's capsule and glomerulus.

DIRECTION : Distinguish between the following pairs:

- 142.** Ureter and Urethra

Ans :

SQP 2017

	Ureter		Urethra
(a)	It transports urine from kidney to urinary bladder	(a)	It transports urine from urinary bladder to the exterior (excretes out).

(b)	Sphincter muscle is absent	(b)	It is guarded by sphincter muscle.
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(b)	It is produced in the liver.	(b)	It is formed in the kidney.
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143. Afferent Arteriole and Efferent Arteriole

Ans :

MAIN 2022

	Afferent Arteriole		Efferent Arteriole
(a)	It carries blood containing waste materials.	(a)	It carries blood having no waste material or less waste material.
(b)	It transports blood to the glomerulus.	(b)	It transports blood away from glomerulus.

144. Excretion and Egestion

Ans :

SQP 2015

	Excretion		Egestion
(a)	It is the removal of metabolic wastes from the body.	(a)	It is the removal of undigested food material from the body.
(b)	It is related with kidney.	(b)	It is related with alimentary canal.

145. Excretion and Secretion.

Ans :

SQP 2001

Urea	Secretion
– It is the removal of nitrogenous metabolic wastes from the body.	– It is the production of chemical substances that is poured into the blood or thrown outside the body in the form of sweat through the sweat pores.

146. Urea and Urine

Ans :

MAIN 2007

	Urea		Urine
(a)	It is a chemical compound.	(a)	It is a mixture of metabolic wastes and other substances.

NODIA

THREE MARKS QUESTIONS**147. Mention the three major steps involved in the production of urine.**

Ans :

SQP 2021

- (1) Ultrafiltration
- (2) Selective reabsorption
- (3) Tubular secretion

148. Give reasons :

- (i) Urine is thicker in summer than in winter.
- (ii) Glucose is normally not found in urine.
- (iii) The renal cortex has a dotted appearance.

Ans :

COMP 2013

- (i) In summer, due to perspiration considerable amount of water is lost. So, more water is reabsorbed in the kidney from the urine making it more concentrated.
- (ii) The glomerular filtrate contains lots of glucose, salt, etc., which are useful. In the proximal convoluted tubule of the nephron, all the glucose is reabsorbed in the blood. Therefore, glucose is normally not found in urine.
- (iii) The renal cortex has dotted appearance because it contains malpighian capsules.

149. Renal Cortex and Renal Medulla

Ans :

MAIN 2009

	Renal cortex		Renal Medulla
(a)	It is the outer reddish region of the kidney.	(a)	It is the inner brown region of the kidney.
(b)	It contains convoluted tubules and renal corpuscles.	(b)	It has Henle's Loop and collecting ducts.
(c)	It looks granular.	(c)	It looks striated.

150. Draw a labelled diagram of the longitudinal section of the kidney.

Ans :

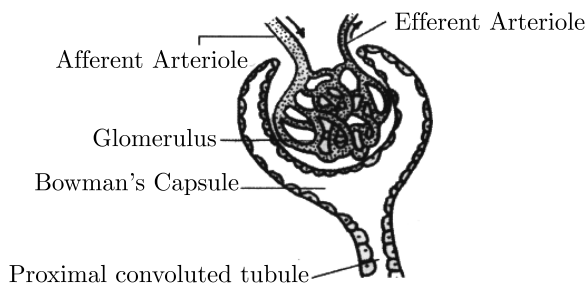
SQP 2009

- (i) Label the parts numbered 1 to 4.
 - (ii) Why does part '2' have a striped appearance?
 - (iii) What is the fluid that passes down part '4'? Name the main nitrogenous waste present in it.
 - (iv) Mention the structural and functional units of kidneys.
 - (v) Name the two major steps in the formation of the fluid mentioned in (iii).
- (b) Draw neat and labelled diagram of Malpighian Capsule.

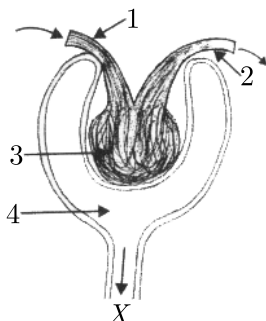
Ans :

COMP 2015

- (a) (i) 1 – Cortex
2 – Medulla
3 – Pelvis
4 – Ureter
 - (ii) Part 2 has striped appearance because the nephrons run about straight in this region and conical pyramids are present.
 - (iii) The fluid that passes down from part 4 is urine. The main nitrogenous waste present in it is urea.
 - (iv) The structural and functional unit of kidney is nephron.
 - (v) The two major steps are:
 1. Ultrafiltration
 2. Selective reabsorption
- (b) Malpighian Capsule



157. Study the diagram and answer the following questions:



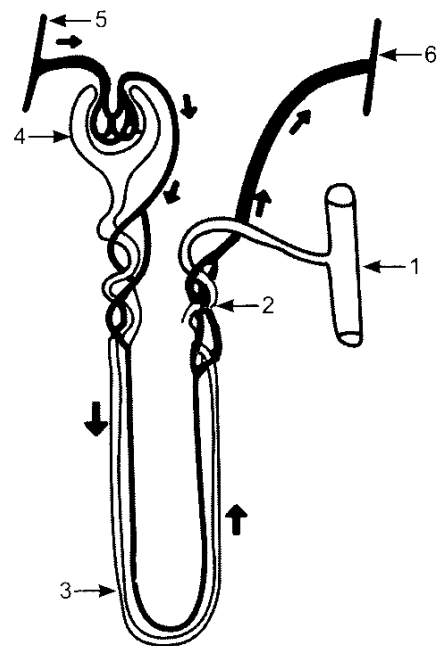
- (i) Label the parts 1— 4.
- (ii) State the structural difference between part 1 and 2.
- (iii) What stage in urine formation occurs in part 3?
- (iv) Name the liquid flowing through 'X'.

Ans :

MAIN 2012

- (i) 1 - Afferent arteriole;
2 - Efferent arteriole;
3 - Glomerulus;
4 - Bowman's capsule
- (ii) The diameter of afferent arteriole is more than efferent arteriole.
- (iii) Ultrafiltration
- (iv) Glomerular filtrate

158. The given diagram represents a nephron and its blood supply. Study the diagram and answer the following questions :



- (i) Label parts 1, 2, 3 and 4.
- (ii) State the reason for the high hydrostatic pressure in the glomerulus.
- (iii) Name the blood vessel which contains the least amount of urea in this diagram.
- (iv) Name the two main stages of urine formation.
- (v) Name the part of the nephron which lies in the renal medulla.

Ans :

SQP 2014

- (i) 1 – Collecting duct
2 – DCT (Distal Convolved Tubes)
3 – Loop of Henle

- (ii) Name the parts labelled 1, 2, 3 and 4.
- (iii) Name the stages involved in the formation of urine.
- (iv) What is the technical term given to the process occurring in 2 and 3 ? Briefly describe the process.
- (v) Give the reason for following statement. "In summer, urine is slightly thicker than in winter."

Ans :

SQP 2011

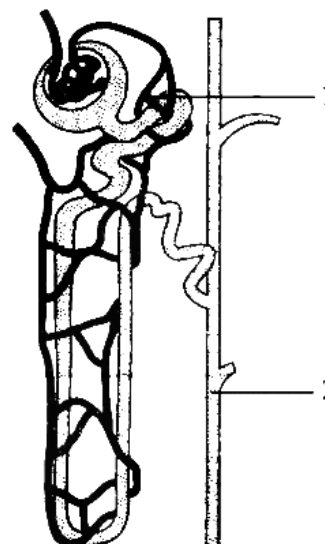
- (i) Cortex of the kidney
- (ii) 1. Afferent arteriole
2. Glomerulus
3. Bowman's capsule
4. Efferent arteriole
- (iii) Ultrafiltration, tubular reabsorption and tubular secretion.
- (iv) Ultrafiltration : When blood passes from afferent arteriole to efferent arteriole having smaller diameter a pressure is built-up in the glomerular capillaries, under this pressure all the substances in the blood get filtered out through the capillary walls. This filtered out liquid is called glomerular filtrate or nephric filtrate.
- (v) In summer urine is slightly thicker than in winter, as in summer due to perspiration a good amount of water is released from the body as sweat. In sweat production, the sweat glands absorb water from the surrounding blood vessels, as a result the blood becomes thicker and more concentrated with solutes. To maintain the concentration and fluidity of the blood, water is absorbed into the blood (by osmosis from the renal tubules in the kidney, hence less urine is formed and urination is less frequent and also the urine is much thicker.
However, during winter; perspiration is less and, therefore, water is not absorbed from the renal tubules in the kidney. Hence, urine remain thinner in winter as compared to that in summer.

155. The diagram given below is that of a structure present in a human kidney.
Study the same and answer the questions that follow:

- (i) Name the structure represented in the diagram.

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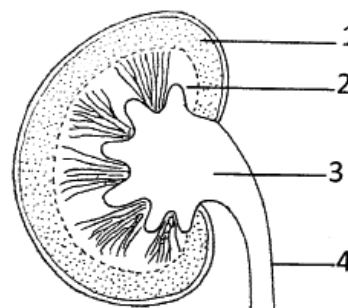
- (ii) What is the liquid entering part 1 ' called? Name two substances present in this liquid that are reabsorbed in the tubule.
- (iii) What is the fluid that comes to part '2' called? Name the main nitrogenous waste in it.
- (iv) Mention the three main steps involved in the formation of the fluid mentioned in (iii) above.
- (v) Name the substance which may be present in the fluid in part '2' if a person suffers from Diabetes mellitus.

Ans :

SQP 2018

- (i) Nephron/Uriferous tubule
- (ii) Glomerular filtrate. Glucose and water soluble salts
- (iii) Urine ; Urea
- (iv) 1. Ultrafiltration
2. Selective reabsorption
3. Tubular secretion
- (v) Glucose

- 156.** (a) The diagram given below shows a section of a human kidney. Study the diagram carefully and answer the questions that follow :



- 102.** The tube that passes urine out of the body is _____.

Ans : MAIN 2005
urethra

- 103.** Blood leaves Bowman's capsule by _____.

Ans : SQP 2020
Efferent arteriole

- 104.** The human kidney is made up of _____.

Ans : SQP 2011
nephrons

- 105.** The inner part of kidney is called _____.

Ans : MAIN 2023
medulla

- 106.** Ureter is the connecting link between _____ and _____.

Ans : SQP 2002
kidney, urinary bladder

- 107.** The sum total of all the chemical reactions taking place in the cell is called _____.

Ans : COMP 2007
metabolism

- 108.** The funnel-shaped structure of kidney is called _____.

Ans : SQP 2000
pelvis

- 109.** Automatic self-regulation of salt and water within the body is called _____.

Ans : MAIN 2017
homeostasis

- 110.** Knot of blood vessel inside the Bowman's capsule is _____.

Ans : MAIN 2013
Glomerulus.

DIRECTION : Choose the ODD one out of the following terms given and name the CATEGORY to which the others belong :

- 111.** Bile, Urea, Uric acid, Ammonia

Ans :

COMP 2017

Bile, urea are excretory products of humans.

DIRECTION : Differentiate between the following pairs on the basis of what is mentioned in brackets:

- 112.** State the difference between Micturition and Parturition.

Ans : SQP 2025

Micturition: It is the expulsion of urine from the urinary bladder.

Parturition: It is the expulsion of the fully developed foetus from the uterus at the end of gestation.

- 113.** Differentiate between Afferent arteriole and Efferent arteriole (diameter).

Ans : MAIN 2024

Afferent arteriole : It has a larger diameter that carries blood from renal artery to the glomerulus.

Efferent arteriole : It has a smaller diameter that carries blood from the glomerulus and into the renal vein.

- 114.** Renal cortex and Renal medulla (Parts of the nephrons present)

Ans : MAIN 2017

Renal cortex : Bowman's capsule, PCT and DCT
Renal medulla : Loop of Henle

- 115.** Bowman's capsule and Malpighian capsule. (parts included) (Excretory System)

Ans : SQP 2013

Bowman's capsule : Include glomerulus

Malpighian capsule : Include glomerulus and Bowman's capsule

- 116.** Ureter and Urethra [function]

Ans : MAIN 2018

Ureter : Removes urine from kidney to bladder

Urethra : Passes urine out of the body

DIRECTION : State whether the following are True or False:

- 117.** Protein diet makes urine acidic.

Ans : SQP 2020

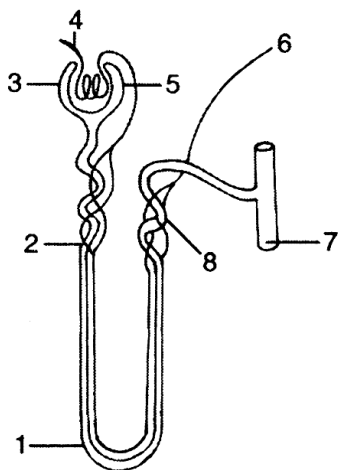
True.

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4 – Bowman's capsule

- (ii) The diameter of afferent arteriole is wider and efferent arteriole is narrower. So, hydrostatic pressure is high in the glomerulus.
- (iii) Renal vein
- (iv) 1. Ultrafiltration
2. Selective reabsorption
- (v) Henle's loop and collecting duct

159. The following diagram represents a mammalian kidney tubule (nephron) and its blood supply. Parts indicated by the guidelines 1 to 8 are as follows :



- 1. U-shaped loop of Henle
- 2. Proximal convoluted tubule with blood capillaries.
- 3. Bowman's capsule.
- 4. Afferent arteriole from renal artery.
- 5. Glomerulus.
- 6. Venule to renal vein.
- 7. Collecting tubule.
- 8. Distal convoluted tubule with blood capillaries.

Study the diagram and answer the following questions in each case:

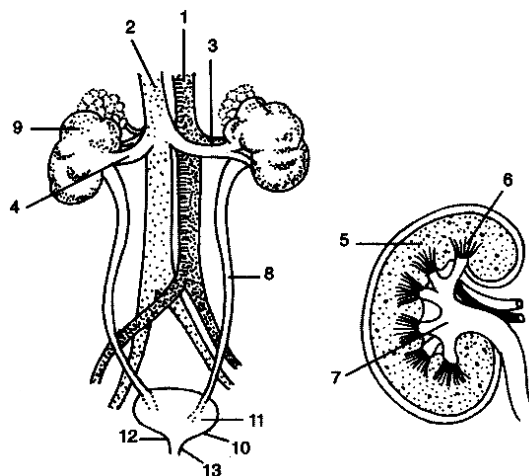
- (i) Where does ultra-filtration take place ?
- (ii) Which structure does contain the lowest concentration of urea ?
- (iii) Which structure does contain the highest concentration of urea ?
- (iv) Which structure does normally contain the lowest concentration of glucose ?

Ans :

SQP 2023

- (i) Glomerulus.
- (ii) Bowman's capsule.
- (iii) Collecting tubule.
- (iv) Collecting tubule.

160.



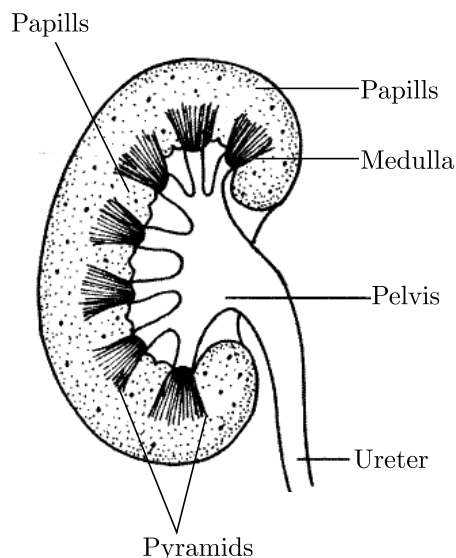
The above diagram is longitudinal section of the kidneys of mammals and associated structures.

- (i) Name the parts indicated by guidelines.
- (ii) Which parts in the above diagram :
1. Produce urine.
2. Store urine.
3. Carry urine to the urinary bladder.
- (iii) Name the blood vessel that carries urea from the liver to the urinary bladder.
- (iv) Give three differences between the composition of blood in renal artery and renal vein.
- (v) Name the substance formed in excess in the urine of a diabetic patient.

Ans :

COMP 2021

- (i) 1. Aorta
2. Venacava
3. Renal artery
4. Renal vein
5. Cortex
6. Medulla
7. Pelvis
8. Left ureter
9. Right kidney
10. Urinary bladder
11. Opening of ureter
12. Sphincter muscle
13. Urethra.
- (ii) 1. Kidney.
2. Urinary bladder.
3. Ureter.
- (iii) Renal artery.
- (iv) The impure blood of renal artery contains, (a) oxygen (b) urea (c) uric acid. The pure blood of renal vein contains CO₂ in addition to other constituents of blood. The urea, uric acid and other nitrogenous substances are filtered in the kidney, so renal vein does not



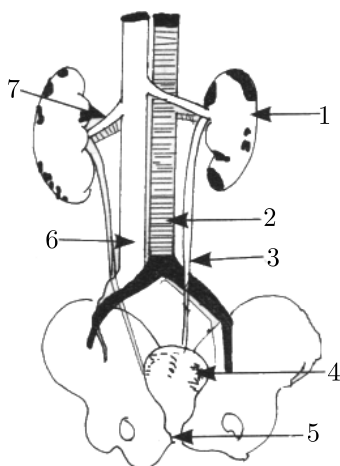
- 151.** Mention the functions of the different parts of a nephron.

Ans :

SQP 2017

- (i) Renal capsule – ultrafiltration
- (ii) Proximal convoluted tubule – reabsorption of water, glucose, sodium and potassium ions.
- (iii) Loop of Henle – reabsorption of water and sodium ions.
- (iv) Distal convoluted tubule – reabsorption of remaining chloride ions and tubular secretion.
- (v) Collecting duct – pours urine into the pelvis.

- 152.** The given figure shows certain organs and associated parts in a mammalian body:



- (i) Name the parts 1 to 7.
- (ii) Which endocrine gland could have been added in the figure and where?
- (iii) Name the fluid flowing down through part 3

and the substances present in it.

Ans :

COMP 2019

- (i) 1- Kidney; 2 - Dorsal aorta; 3 - Ureter; 4 - Urinary bladder; 5 - Urethra; 6 - Vena cava; 7 - Renal vein.
- (ii) Adrenal gland on top of each kidney.
- (iii) Urine. The substances present in urine are water, urea, sodium chloride, etc.

DIRECTION : Complete the following paragraph by filling in the blanks (i) to (v) with appropriate words :

- 153.** The amount of urine output is under the regulation of a hormone called

- (i) _____ secreted by the (ii) _____ lobe of the pituitary gland. If this hormone secretion is reduced, there is an increased production of urine. This disorder is called (iii) _____. Sometimes excess glucose is passed with urine due to hyposecretion of another hormone called (iv) _____ leading to the cause of a disease called (v) _____.

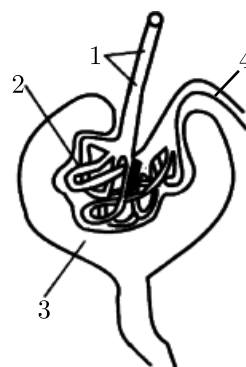
Ans :

MAIN 2016

- (i) Antidiuretic/Vasopressin Hormone
- (ii) Posterior
- (iii) Diabetes insipidus/Diuresis
- (iv) Insulin
- (v) Diabetes mellitus

FIVE MARKS QUESTIONS

- 154.** Study the diagram given below and then answer the questions that follow :



- (i) Name the region in the kidney where the above structure is present.

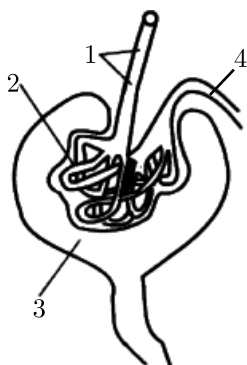
by blood capillaries surrounding the nephron. The nephrons drain the waste into a space inside kidney leading to the ureter. Human urine contains water and nitrogenous substances, most of which is urea. From the ureter, urine passes into the urinary bladder and is stored there till thrown out of the body.

(iii) Functions of human kidney :

- (1) Kidneys remove toxic wastes from the body.
- (2) Kidneys help in the reabsorption of useful products in the body.
- (3) Kidneys help in regulating water content and controlling water balance in the body.
- (4) Kidneys also control the levels of mineral ions the body.

164. There is the diagram of a part of the nephron of the kidney. Study the same and answer the questions that follow:

- (i) Name the parts labelled 1, 2 and 3.
- (ii) Name the region in the kidney where the given structure is present.
- (iii) What is the collective term used for 2 and 3?
- (iv) Why is the right kidney at a slightly lower level than the left?
- (v) Explain the term homeostasis. What is the role of the kidney in this?



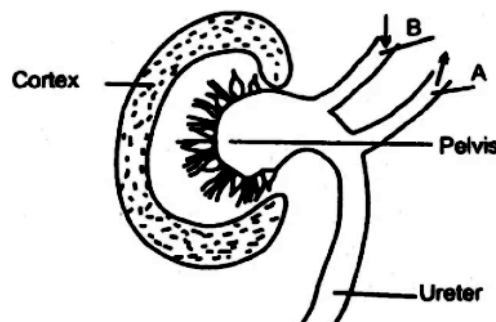
Ans :

MAIN 2017

- (i) 1 – Afferent arteriole;
2 – Glomerulus;
3 – Bowman's capsule.
- (ii) Cortex
- (iii) Malpighian capsule
- (iv) Liver occupies a large space. So, right kidney is slightly lower level than the left.
- (v) Homeostasis means keeping a constant internal environment irrespective of the outside environment. It is performed by

kidneys. They eliminate all metabolic wastes, excess water and salt, thereby maintaining electrolyte and water equilibrium in the body.

165. Given below is a simple diagram of the human kidney cut open longitudinally. Answer the following questions:



- (i) Give the definition of excretion.
- (ii) Name the functional unit of the kidney.
- (iii) Why does the cortex of the kidney show a "Dotted" appearance?
- (iv) Mention two functions of the kidney.
- (v) Write the difference in the composition of the blood flowing through blood vessels A and B.

Ans :

COMP 2009

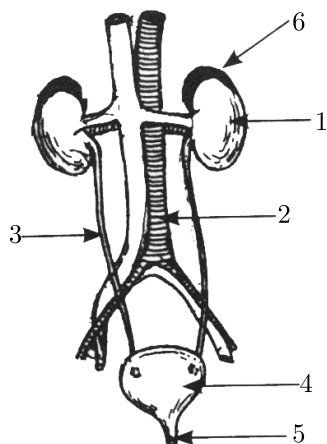
- (i) It is the process for removal of metabolic wastes from the body.
- (ii) Nephrons
- (iii) It is due to the presence of Malpighian capsules.
- (iv) Formation of urine and osmoregulation.
- (v)

	A - Renal Artery		B - Renal Vein
1.	It contains more urea	1.	It contains less urea
2.	The blood flowing through it is oxygenated.	2.	The blood flowing through it is deoxygenated.
3.	It contains more salts, water, etc.	3.	It contains less salt, water, etc.

166. Given is the figure of certain organ and its associated parts. Study the same and then answer the questions that follow:

- (i) Name all the organ systems shown completely or even partially.
- (ii) Name the parts numbered 1 to 6.
- (iii) Name the structural and functional unit of the part marked 1.

- (iv) Name the two main organic constituents of the fluid that flows down the part labelled '3'.
- (v) Name the two major steps involved in the formation of the fluid that passes down the part labelled '3'.



Ans :

SQP 2002

- (i) Excretory system, Circulatory system, Endocrine system
- (ii) 1 – Left kidney;
2 – Dorsal aorta;
3 – Ureter;
4 – Urinary bladder;
5 – Urethra
- (iii) Nephron
- (iv) Urea and creatinine
- (v) Ultrafiltration and selective reabsorption.

- 167.** (i) Explain, how the kidneys function.
- (ii) Define Osmoregulation. Why is it considered important for an organism ?
- (iii) What happens to the useful substances which flow into nephridia along with the waste ?

Ans :

COMP 2011

- (i) Kidney function involves two processes ultrafiltration and active transport. Ultrafiltration is filtration under pressure: blood is 'squeezed' to separate a fluid called glomerular filtrate (often called simply the filtrate). Active transport then modifies the filtrate, secreting some substances and reabsorbing others according to the needs of the body. The result is that blood flows back into the body without much of its harmful waste. This waste, a solution containing urea, salts and various other chemicals, is called urine.

- (ii) Osmoregulation is the maintenance of a constant solute concentration within the body. It is considered important because, if we place animal cells in a hypertonic solution, they lose water by osmosis and shrivel. If we put them in a hypotonic solution they gain water and may burst. Both situations are harmful to cells, and so it is important that animals maintain the solute concentration of their body fluids within narrow limits.
- (iii) Useful substances like glucose, amino acids, etc., are reabsorbed by cells lining the tubules nephridia and are passed into the blood.

- 168.** (i) Briefly describe the mechanism of urine formation in man.
- (ii) In what way is kidney a homeostat organ ?
- (iii) Write the functions of kidney.

Ans :

SQP 2020

- (i) Urine formation in man consists of three different stages :
- (1) Ultrafiltration : This is the first stage of urine formation when blood in the afferent arteriole enters into the glomerulus with great pressure and filters the liquid part of the blood into the Bowman's capsule which is called glomerular filtrate. This filtrate consists of water, urea, salts, glucose and other solutes of plasma. Corpuscles and other insoluble particles are left behind in the glomerulus.
 - (2) Selective Reabsorption : This is the second stage of urine formation when extra glucose and water are re-absorbed in the tubule which the body does not want to lose. Normal concentration of the blood remains constant during this process as the urine passes through the renal tube.
 - (3) Secretion : This is the last stage of urine formation when excess vitamins, alcohols, drugs and dyes enter into the urine from the blood capillaries by the process of diffusion. Thus, all waste materials are removed from the body by urine formation and passing the urine out of the body.
- (ii) Homeostasis means maintenance by an organism of a constant internal environment. Kidney helps to maintain a steady or constant state of internal atmosphere by excreting waste products and reabsorbing useful substances like water and salts of sodium

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and potassium. It also maintains the water contents of blood constant.

(iii) Kidney does the following functions in the human body :

- (1) It separates the excretory products like urea, uric acid from the blood and eliminates them as waste material in the urine.
- (2) Kidney maintains a constant composition of blood.
- (3) Kidney helps in maintaining the correct pH balance by filtering the acidic substance from blood.

CASE BASED QUESTION

169. A 50-year-old man suffers from shortness of breath and has an abnormal buildup of fluid in his body. Doctors suspect kidney malfunction and warn of dropsy if untreated. They advise the patient to undergo a detailed kidney function test to prevent further complications.

1. What is dropsy?
2. Which organ helps in osmoregulation?
3. What does the kidney regulate besides water balance?
4. What nitrogenous waste is removed by the kidneys?

Ans ::

1. Dropsy is the accumulation of fluid in the body due to improper kidney function.
2. The kidneys help maintain water balance in the body.
3. The kidney regulates acid-base balance and blood pressure.
4. The kidney removes urea, uric acid, and ammonia.

170. A 35-year-old individual experiences discomfort when urinating. Tests show increased uric acid levels in the body, pointing to a potential issue with nitrogenous waste removal. Doctors recommend reducing foods high in purines to prevent further complications.

1. What does high uric acid indicate?
2. How does the kidney remove waste?
3. What structure in the kidney filters blood?
4. Where is urine stored before being excreted?

Ans ::

1. High uric acid may indicate improper kidney function.
2. Through ultrafiltration, reabsorption, and secretion.
3. The glomerulus filters the blood.
4. Urine is stored in the urinary bladder.

171. A patient with severe kidney damage is unable to urinate properly. The medical team plans to start dialysis to remove harmful wastes from the blood. Without dialysis, the buildup of nitrogenous waste can cause life-threatening conditions.

1. What is dialysis?
2. What wastes do kidneys normally excrete?
3. What is the main function of the nephron?
4. What fluid balance process does the kidney manage?

Ans ::

1. Dialysis is a process to remove waste products when kidneys fail.
2. Kidneys excrete urea, uric acid, and ammonia.
3. The nephron filters blood and produces urine.
4. The kidney manages osmoregulation.

172. A young athlete is diagnosed with dehydration due to excessive sweating during training. The doctor explains that the kidneys are working harder to retain water and maintain solute balance in the body. They advise increased water intake to avoid dehydration.

1. What role do kidneys play in dehydration?
2. What waste does the skin excrete?
3. Which part of the kidney controls water balance?
4. What type of waste do kidneys filter out?

Ans ::

1. Kidneys conserve water during dehydration.
2. The skin excretes sweat.
3. The distal tubules help regulate water balance.
4. Kidneys filter out nitrogenous wastes like urea.

173. A person is advised to avoid high-protein food due to impaired kidney function, which could increase nitrogenous waste production. The doctor also suggests reducing salt intake to avoid putting additional pressure on the kidneys.

1. Why should the person avoid high-protein food?
2. What process removes nitrogenous waste?
3. Which organs are involved in excretion?

Structure of Eyeball :

The wall of eyeball is composed of three concentric layers : (i) Outer sclerotic, (ii) Middle choroids, (iii) Inner retina.

- (i) **Sclerotic layer or Sclera** : Made up of tough fibrous tissue and is white making the white portion on the front of the eye. It bulges out and becomes transparent in the front region where it covers the coloured part of the eye; the cornea. The cornea derives oxygen by diffusion therefore excessive use of contact lens is not recommended as it could lead to the drying of the cornea. This cornea sometimes becomes opaque (white) and non-functional (defective) which can be then replaced by a healthy cornea from a donated eye.

Covering the entire anterior surface of sclera is a thin membrane called conjunctiva which when gets infected by a virus turns this thin membrane red and develops a condition called conjunctivitis.

- (ii) **Choroid** : This layer is richly supplied with blood vessels for providing nourishment to the organ. It is dark black in colour and darkens the inner side of eyeball. In front of eye choroid expands to form a ciliary body. The smooth muscles in the ciliary body alter the shape of the lens. Continuous with the choroids is a coloured disc of tissue called iris partially covering the lens and leaving a circular opening in the centre called pupil. The blue, brown or black colour of eye refers to the colour of the iris. The iris contains radial muscles to widen and circular muscles to constrict the pupil which regulates the amount of light entering the eye.

- (iii) **Retina** : It is the innermost, light sensitive layer of the eyeball covering the choroids and ending at the edge of the ciliary body. It contains two types of photosensitive cells called Rods and Cones. The rods contain the pigment rhodopsin (visual purple) and are concentrated more towards the periphery of retina. They respond to light of low intensity (dim light) and do not respond to colour. The cones contain pigment iodopsin (visual violet) and are most densely concentrated in the yellow spot. Cones are specialized for colour vision and sharpness of vision in bright light. As a result the yellow spot is called as the area of the best or brightest vision of a normal eye. Lying below the yellow spot is a small area on the retina called blind spot

which contains opening through which the nerve fibres from all the sensitive cells of the retina converge and bundle together to leave the eyeball in the form of optic nerves. There are no sensory cells in the blind spot and therefore this is the point of no vision and image striking it cannot be perceived.

Lens of the Eyes :

It is a transparent, biconvex crystalline body held by fibres called suspensory ligament which attaches it to the ciliary body. There is no blood in the lens. The lens refracts the light and converges it on the retina. The lens of eye divides the interior of the eye into two chambers - the aqueous chamber which is filled with a watery fluid called aqueous humour (keeps the lens moist and protects it from mechanical shocks) and vitreous chamber which is filled with a jelly like substance called vitreous humour (maintains the shape of the eyeball). The humours contain dissolved salts, proteins and glucose.

Working of Eye :

Light rays from the object enter our eyes through conjunctiva, cornea, aqueous humour, lens and vitreous humour. The curvature of cornea bend and converge the light rays to form an image on retina. The image formed on retina is inverted and real.

Sterioscopic (binocular) Vision :

When both the eyes are focussed on the same object but from different angles it is called binocular or stereoscopic vision. All monkeys, apes and particularly man have binocular vision. This vision enables man to judge the distances correctly and also provides depth to the image.

Abnormalities or Defects of Eye :

- (i) **Near or short sightedness (Myopia)** : Near vision is clear while distant vision is blurred. It is because of the lens becomes too convex or curved and eyeball of too great depth (eyeball lengthened from front to back). It leads to decrease in the focal length of eye lens and image of the distant object is formed in front of the retina. it is corrected by wearing concave lenses which causes parallel rays of light to diverge before they converge and focus on the retina. The power of glasses used is mentioned in minus.
- (ii) **Far or long sightedness (Hyperopia, old term Hypermetropia)** : Distant vision is clear while near vision is blurred. This is because the lens becomes less convex or too flattened and

CHAPTER 9

NERVOUS SYSTEM AND SENSE ORGANS

SUMMARY

1. NERVOUS SYSTEM AND ITS FUNCTIONS

The nervous system provides the fastest means of communication within the body so that suitable responses to stimuli can be made at once. It controls activities, functioning of our internal organs, movements, perceptions and even our thoughts and emotions. It receives information of changes in the external environment and analyses and interprets them to produce sensations. It also receives information of changes in the interior of the body and co-ordinates the activities of visceral organs in the light of those changes; thereby it helps to maintain the constancy of the internal environment in the body. It enables us to think, remember and reason out. It controls and harmonises all voluntary muscular activities.

1.1 The unit of Nervous System-Neurons (nerve cells)

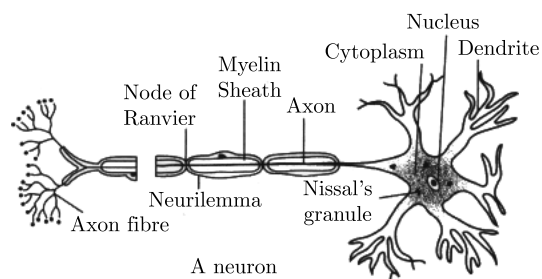
Neurons are the structural and functional unit of nervous system and once they are formed in the embryo do not divide further because of the absence of centrosome. Once dead, they are not replaced. Every set of co-ordinated movements whether skilled performances or routine tasks like cycling or driving a car, all involve the integrating powers of the nervous system.

A neuron consists of the cell body (Perikaryon or cyton) which contains a nucleus surrounded by granular cytoplasm. There are certain branched cytoplasmic projections of the cell body called dendrites. One of the dendrite extends and forms the axon of the neuron. Axon is a long process from the cell body and in most neurons it is surrounded by a white insulating sheath called neurilemma. The end portions of axons have swollen ends like bulbs which store certain chemicals called neurotransmitters (acetylcholine is one such neurotransmitter). There is a synapse, which is a point of contact between the terminal branches of the axon of a neuron with the dendrites

of another neuron separated by a fine gap.

Dendrites and axon are collectively called as neuritis.

The speed of nerve impulse is 100 metres per second while the electricity is conducted through a wire at a speed of about 1,50,000 km per second.



A neuron

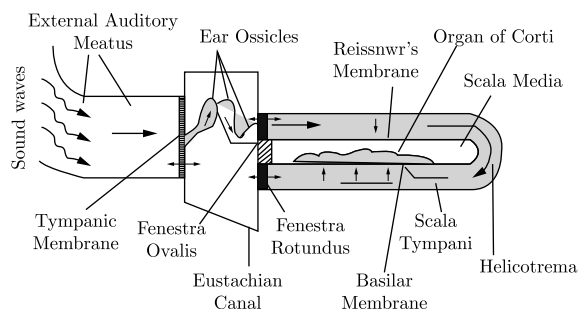
1.2 Nerves

These are thread like white structures which emerge from the brain and spinal cord and branch out to almost all parts of the body. It is formed of a bundle of nerve fibres (axons) enclosed in a tubular sheath. There are three kinds of nerves. These are - sensory nerves containing only sensory fibres bringing impulses from receptors to brain or spinal cord. Motor nerves contain only motor fibres carrying impulses to effector organs (muscles or glands) from brain or spinal cord. Mixed nerves carry both sensory and motor fibres.

In mammals, the nervous system consists of central nervous system (CNS), peripheral nervous system (PNS) and autonomic nervous system (ANS). The CNS includes brain and spinal cord. The PNS includes sensory nerves that keeps the body in touch with the outside world along with the nerves that govern bodily responses to that world. The ANS controls the internal environment and governs the involuntary activities.

2. THE CENTRAL NERVOUS SYSTEM (CNS)

All the parts of the nervous system which are present along the median longitudinal axis constitute the CNS. It includes the brain and spinal cord. Brain is the upper part of the CNS



Passage of sound vibrations in the process of hearing in a mammal.

MULTIPLE CHOICE QUESTION

1. The antiseptic present in tears:

(a) Iodine
(b) Hydrogen peroxide
(c) Lysozyme
(d) Lysosome

Ans :

SQP 2025

Thus (c) is correct option.

2. The two cerebral hemispheres are joined by a sheet of fibres called:

(a) Pons
(b) Corpus luteum
(c) Hypothalamus
(d) Corpus callosum

Ans :

SQP 2025

Thus (d) is correct option.

3. Rahul inserted a hairpin into his right ear to remove ear wax. He felt a sudden sharp pain with loss of hearing. This was due to:

(a) Rupture of eardrum
(b) Rupture of vestibule
(c) Rupture of cornea
(d) Rupture of pinna

Ans :

SQP 2025

Thus (a) is correct option.

4. **Assertion (A)** : Rods and Cones are photoreceptors in the sclera of eyeball.

Reason (R) : Rods are sensitive to dim light.

(a) Assertion is True and Reason is False.
(b) Assertion is False and Reason is True.
(c) Both Assertion and Reason are True.
(d) Both Assertion and Reason are False.

Ans :

SQP 2025

Thus (b) is correct option.

5. Adjusting the focal length of the eye lens to view objects at different distances is done by:

(a) Cornea
(b) Iris
(c) Ciliary outgrips
(d) Sclera

Ans :

MAIN 2024

The ciliary muscles are responsible for adjusting the shape of the lens within the eye, which in turn alters its focal length. This helps in focusing on objects at varying distances, allowing the eye to accommodate near and far vision effectively.

Thus (c) is correct option.

6. The ear ossicle that transports sound vibrations to the inner ear:

(a) Stapes
(b) Malleus
(c) Incus
(d) Cochlea

Ans :

MAIN 2024

The ear ossicle that transports sound vibrations to the inner ear is stapes. The stapes specifically transfer these vibrations to the oval window, where they are then transmitted into the fluid-filled cochlea of the inner ear, initiating the process of hearing.

Thus (a) is correct option.

7. The ventral root ganglion of the spinal cord contains cell bodies of the :

(a) Motor neuron
(b) Sensory neuron
(c) Intermediate neuron
(d) Association neuron

Ans :

SQP 2013

The ventral root ganglion of the spinal cord contains cell bodies of the motor neuron.

Thus (a) is correct option.

8. Which one of the following is mainly associated with the maintenance of the posture ?

(a) Cerebrum (b) Cerebellum
(c) Thalamus (d) Pons

Ans :

MAIN 2015

Cerebellum is mainly associated with the maintenance of the posture.

Thus (b) is correct option.

cord is just reverse of that in the brain i.e. white matter is outside and gray matter is in the centre. The gray matter penetrates into the white matter in the form of horns like the alphabet 'H'.

3. PERIPHERAL NERVOUS SYSTEM

It consists of nerves which arise from CNS (brain and spinal cord) and connect different parts of the body. It consists of Cranial nerves and Spinal nerves.

Cranial nerves are those nerves which arise from the brain. In man there are 12 pairs of cranial nerves. The cranial nerves may be sensory (afferent), motor (efferent) or mixed in nature. Spinal nerves are those nerves which arise from the spinal cord and are 31 pairs in number. These are cervical, thoracic, lumbar, sacral and coccygeal nerves. All spinal nerves are mixed nerves.

4. AUTONOMIC NERVOUS SYSTEM

The part of nervous system which controls all the involuntary activities of various body viscera is called ANS. It is divided into two parts - Sympathetic and parasympathetic nervous system which are antagonistic to each other. Sympathetic nervous system prepares the body for violent action during emergency while parasympathetic nervous system helps in re-establishing normal conditions after violent act is over.

5. REFLEXES (INVOLUNTARY ACTIONS)

There are two types of action which occur in our body - Voluntary (under the control of our will power, non-spontaneous, non-automatic and are controlled by cerebrum of brain) and Involuntary actions (not under the control of our will power, spontaneous, automatic and without involvement of brain).

5.1 Reflex Action

It is a spontaneous, involuntary, automatic, mechanical and stereotyped response to any sensory stimulus without the involvement of the brain. These are of two types :

- (i) **Natural or inborn or simple or unconditioned reflexes :** It is one in which no previous experience or learning is required. These are inherited from parents. e.g. coughing, blinking of eyes, swallowing etc.
- (ii) **Acquired or conditioned reflexes :** It is one which develops during lifetime due to experience or learning. e.g. applying brakes, using keys of keyboard of computers, playing

a musical instrument, etc.

Significance of Reflexes :

- (i) They are the spontaneous response to any harmful stimulus thereby protecting from the harm that could be done if delayed.
- (ii) These relieve the burden of brain by automatically responding to routine stimuli.
- (iii) Conditioned reflex such as the wild animals in a circus are trained to perform many strange acts.

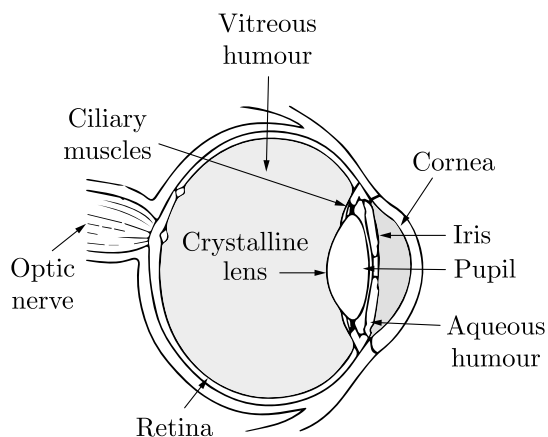
6. SENSE ORGANS

Sense organs are the sensory receptors found associated together in systems. Several types of sense organs are present in human body. These sense organs enable us to be aware of the conditions of the environment. The major sense organs in our body are eyes, ears, nose, tongue and skin.

6.1 The Eyes (Sense organs of sight-photoreceptors)

Eyes are the sense organs for vision or sight. The two eyes are located in deep sockets or orbits on the front side of the head. Each eye is a spherical ball like structure called as eyeball. There are two movable upper and lower eyelids that protects the eye from any kind of injury and clean the surface of eyeball by regular blinking. On the free margins of eyelids in a row are present very small but thick hairs called eyelashes. They act as strainers and do not allow dust and other foreign particles to enter in the eye. There are some arched eminences of skin above the eyes and bear hair called as eyebrows. They protect the eyes from dust, sweat, water and direct rays of the sun.

Located at the upper sideward portion of the orbit are present tear or lacrimal glands. Six or twelve ducts of the gland pour the secretion over the front surface.



4. What condition occurs if urea builds up in the blood?

Ans ::

1. High-protein food increases urea production.
2. Excretion removes nitrogenous waste.
3. The kidneys, liver, skin, and lungs.
4. This leads to Uremia.

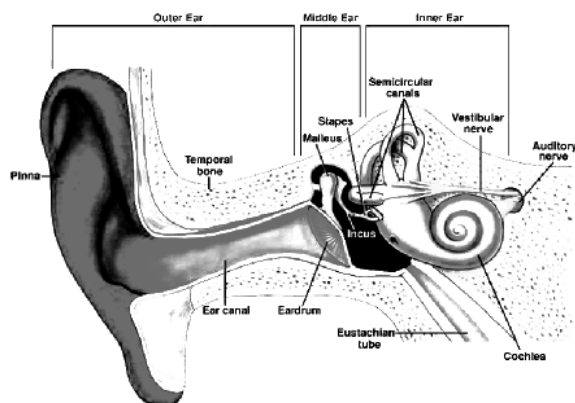
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eyeball of too short depth (eyeball shortened from front to back). It leads to increase in focal length of eye lens and thus image is formed behind the retina. It is corrected by wearing convex lens. The power of glasses used is mentioned in plus.

- (iii) **Astigmatism** : Some parts of the object is seen in focus while others are blurred. It is corrected by cylindrical lenses.
- (iv) **Presbyopia** : It is due to loss of flexibility of the lens, generally after the age of 40 years. It creates difficulty in focusing on near objects. It is corrected by convex lens.
- (v) **Cataract** : The lens turns opaque and vision is cut down even to total blindness. The only cure of cataract is the removal of defective lens.
- (vi) **Glaucoma** : Over production of vitreous humour increases pressure on the delicate retina and crushes its delicate cells causing blindness. An operation needs to be performed to drain excess fluid and restore normal pressure.
- (vii) **Night blindness** : Difficulty to see in dim or diffused light is called night blindness. It is because of failure of formation of visual purple pigment by rod cells. Deficiency of vitamin A causes this disease.
- (viii) **Colour blindness** : Inability to distinguish between various colours is called colour blindness. It is a genetic disorder and is more common in males.

6.2 The Ears (sense organ for hearing and equilibrium)

A pair of ears present on lateral sides of head, one on either side behind each eye are the organs for perceiving the sound waves. The ears interpret these sound waves and help in analyzing the pitch, quality, timbre, intensity and direction of the sound waves.



The human ear has three main divisions :

- (i) **The External ear** : It consists of projecting part pinna and the auditory canal leading to ear drum. Pinna collects sound waves and direct these waves into external auditory canal.
- (ii) **The Middle ear** : It is an air-filled, irregular space called tympanic cavity. It opens into pharynx through Eustachian tube which acts as a ventilator to equalize pressure of air on both sides of tympanic membrane. Running across the middle ear from tympanum to oval window is present a more or less mobile chain of three small bones called ear ossicles which are outer malleus, middle incus and inner stapes.
- (iii) **Internal ear** : It is represented by an irregular very delicate structure called membranous labyrinth which has three parts :
 - (a) Semicircular canal - Helps in dynamic equilibrium
 - (b) Vestibule
 - (c) Cochlear duct.

Main Functions of Ear :

The ear performs two unrelated functions hearing and equilibrium.

1. Hearing :

External pinna collects the sound waves and after concentrating passes on to tympanic membrane through auditory canal. The tympanic membrane starts vibrating. These vibrations are conveyed to the membrane over fenestra ovalis through the ear ossicles. The vibrations in the membrane over oval window are passed on to the perilymph in the upper scala of cochlea. These vibrations are transmitted to the endolymph of middle scala and the basilar membrane starts vibrating. The vibrating basilar membrane stimulates the sensory (hair) cells of organ of corti. The sensory cells convert the sound waves into nerve impulses that are carried to the brain through auditory nerve. It is the brain which analyses the pitch, quality, timbre, intensity and direction of the sound waves.

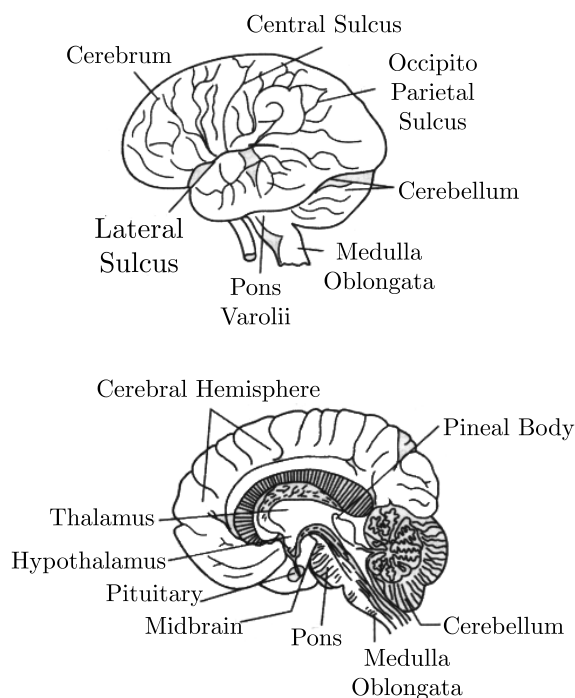
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2. Equilibrium :

which lies within the brain box. It is continued downwards as the spinal cord which is placed within the vertebral canal. The brain and spinal cord is protected by three successive layers of fibrous coverings (piamater, arachnoid mater and duramater) called Meninges. In-between the layers of meninges a cerebrospinal fluid is present which serves as shock absorbing medium and protects the brain and rest of the CNS against jerk and jolt.

2.1 The Brain

The human brain is highly developed and is largest among all animals. In an average it weighs about 1350g approximately. It is made-up of about 1000 billion neurons. An instrument called Electroencephalogram (EEG) records the waves of brain.



The human brain can be distinguished into three regions, forebrain, midbrain and hindbrain. The hind brain continues into spinal cord.

- (a) The Forebrain is the largest part of human brain which is differentiated into three parts :
 - (i) **Olfactory lobes** : These are a pair of poorly developed bodies which are visible from the ventral surface only since they are hidden beneath the cerebrum. They are concerned with sense of smell.
 - (ii) **Cerebrum** : It is the largest part of the brain and consists of two lobes called cerebral hemispheres which are held

together by a transverse band of nerve fibres called corpus callosum. The outer layer of cerebrum known as cerebral cortex is formed of gray matter and the inner of white matter. The surface of cerebrum shows many folds and grooves called gyri and sulci which increase the surface area to accommodate more nerve cells and hence believed to be of greater intelligence. The human cerebrum performs many functions which are localized in different parts.

- (iii) **Diencephalon** : It is a small lobe completely covered superiorly by large cerebrum but visible from the inferior surface as a small area. It lies between cerebrum and mid brain. It is distinguishable into two parts the thalamus and hypothalamus.

Thalamus acts as relay centre for various senses except smell. It also contains reflex centres for muscular and glandular activities. Hypothalamus controls water balance, fat metabolism, eating, blood pressure, body temperature, sleep and control of pituitary gland, hunger, thirst, anger and pleasure.

- (b) The Midbrain is significantly small about 2 cm long. It connects the hind brain with forebrain and convey impulses.
- (c) The Hindbrain consists of three parts : cerebellum, medulla oblongata and pons varolii. Medulla oblongata, pons varolii, midbrain and hypothalamus are collectively called as brain stem. Pons varolii carries impulses from medulla oblongata to forebrain and co-ordinates muscular movements on both sides.

Cerebellum is the largest part of hind brain present below the cerebrum and above the medulla oblongata, behind the pons. It consists of two large lateral lobes called cerebellar hemispheres. Cerebellum helps to maintain the balance or equilibrium during movements. It also controls and coordinates the movements of various groups of muscles.

Medulla oblongata extends from pons to spinal cord. Most of the involuntary activities of body viscera are controlled by different areas of medulla oblongata.

2.2 The Spinal Cord

The spinal cord is a long, unsegmented, cord like structure about 25 cm in length and 35 g in weight. The distribution of matter in the spinal

9. The number of Spinal nerves in a human being are :

(a) 31 pairs (b) 10 pairs
(c) 21 pairs (d) 30 pairs

Ans :

COMP 2013

The human body has 31 pairs of spinal nerves that connect the spinal cord to the periphery.

Thus (a) is correct option.

10. Aqueous humour is present between the :

(a) Lens and Retina
(b) Iris and Lens
(c) Cornea and Iris
(d) Cornea and Lens

Ans :

MAIN 2018

Aqueous humor is the liquid which is present between eye lens and cornea.

Thus (d) is correct option.

11. Organ of corti is present inside the :

(a) Cochlea
(b) Semicircular canals
(c) Sacculus
(d) Utriculus

Ans :

COMP 2021

The organ of Corti, also known as the spiral organ, is located in the cochlea of the mammalian inner ear. The cochlea is a fluid-filled, snail-like structure that contains the organ of Corti, which is responsible for hearing

Thus (a) is correct option.

12. A structure of neuron comprises of

(a) cell body, dendrites, axon
(b) cell body, synaptic knob, ganglia
(c) synaptic vesicles, ganglia, dendrites
(d) cell body, dendrites, ganglia

Ans :

COMP 2015

A neuron has three main parts: dendrites, an axon, and a cell body or soma (see image below), which can be represented as the branches, roots and trunk of a tree, respectively.

Thus (a) is correct option.

13. Which of the following parts of human ear contribute in hearing?

(a) Semicircular canals, utriculus and sacculus
(b) Eustachian tube, tympanum and utriculus
(c) Perilymph, ear ossicles and semicircular canals
(d) Cochlea, ear ossicles and tympanum

Ans :

MAIN 2010

The cochlea, ear ossicles, and tympanum are the three main parts of the human ear that contribute to hearing.

Thus (d) is correct option.

14. A mixed nerve is one which

(a) carries sensations from 2 or more different sense organs.
(b) has a common root but branches into two or more nerves to different organs.
(c) has two or more roots from different parts of brain.
(d) contains both sensory and motor fibres.

Ans :

MAIN 2005

A mixed nerve is any nerve that contains both sensory (afferent) and motor (efferent nerve fibers)

Thus (d) is correct option.

15. The number of spinal nerves in a human being are

(a) 10 pairs (b) 31 pairs
(c) 21 pairs (d) 30 pairs

Ans :

COMP 2000

The human body has 31 pairs of spinal nerves that connect the spinal cord to the periphery.

Thus (b) is correct option.

16. From which of these, tears come?

(a) Eyeball
(b) Aqueous chamber
(c) Lachrymal glands
(d) Vitreous chamber

Ans :

MAIN 2001

Lachrymal glands are almond-shaped glands that produce and secrete tears through ducts that empty onto the conjunctiva's surface.

Thus (c) is correct option.

17. The organ that helps in hearing is

(a) organ of Corti
(b) cochlea
(c) semicircular canals
(d) ear ossicles

Ans :

SQP 2016

This action is passed onto the cochlea, a fluid-filled snail-like structure that contains the organ of Corti, the organ for hearing. It consists of tiny hair cells that line the cochlea. These cells translate vibrations into electrical impulses that are carried to the brain by sensory nerves.

Thus (a) is correct option.

- 35.** The basic structural and functional unit of brain is :

(a) Nephron (b) Neuron
(c) Spinal cord (d) Nerve

Ans :

SQP 2005

The basic structural and functional unit of the brain is the neuron, also known as a nerve cell. Neurons are specialized cells that receive, process, and transmit information in the form of electrical or chemical signals.

Thus (b) is correct option.

- 36.** The ventral root ganglion of the spinal cord contains cell bodies of the

(a) sensory neuron
(b) intermediate neuron
(c) motor neuron
(d) association neuron

Ans :

MAIN 2013

The ventral root ganglion of the spinal cord contains cell bodies of the motor neuron.

Thus (c) is correct option.

- 37.** Which one of the following forms the pigmented layer in eye?

(a) retina (b) choroid
(c) sclera (d) fovea

Ans :

COMP 2002

Pigmented layer in the eye is called the choroid.

Thus (b) is correct option.

- 38.** The outer layer of meninges is

(a) pia mater (b) arachnoid
(c) neurilemma (d) dura mater

Ans :

MAIN 2008

The tough outer layer is called the dura mater.

Thus (d) is correct option.

- 39.** The control centre for respiration is

(a) cerebrum
(b) cerebellum
(c) corpus callosum
(d) medulla oblongata

Ans :

SQP 2008

The respiration control center is located in the medulla oblongata and pons of the hindbrain. The primary respiratory center is the medullary respiratory center. It comprises two groups of neuronal cell bodies: dorsal and ventral respiratory groups.

Thus (d) is correct option.

- 40.** Which one of the following is mainly associated with the maintenance of the posture?

(a) Cerebellum (b) Cerebrum
(c) Thalamus (d) Pons

Ans :

MAIN 2010

Cerebellum is mainly associated with the maintenance of the posture.

Thus (a) is correct option.

- 41.** The region where the image is sharpest is known as

(a) blind spot (b) rod region
(c) fovea (d) retina

Ans :

MAIN 2023

The region where the image is sharpest is known as the fovea.

Thus (c) is correct option.

- 42.** The largest part of the brain is

(a) pons (b) cerebrum
(c) cerebellum (d) medulla oblongata

Ans :

SQP 2001

The largest part of the brain is cerebrum. The cerebrum is the front of the brain containing the cerebral cortex on the outside and white matter at its center. The cerebrum is responsible for coordination in movements and temperature regulation. It is also responsible for speech, thinking and reasoning, problem-solving, emotions, and learning. Sensory activities of sense organs are also the function of the Cerebrum.

Thus (b) is correct option.

- 43.** Cerebrum is a part of

(a) forebrain (b) mid brain
(c) neuron (d) hind brain

Ans :

COMP 2023

The forebrain is the largest part of the brain and comprises the cerebral hemispheres.

Hence, the cerebrum is a part of the forebrain and is concerned with receiving impulses from sensory organs.

Thus (a) is correct option.

- 44.** The organ in ear that helps to maintain equilibrium is

(a) cochlea (b) organ of Corti
(c) ear ossicles (d) semicircular canals

Ans :

MAIN 2016

Ans :

SQP 2016

Pons is involved in the control of breathing, communication between different parts of the brain, and sensations such as hearing, taste, and balance but not consciousness on a whole. Consciousness is regulated by brain stem.

Thus (d) is correct option.

27. A mixed nerve

- (a) carries sensations from two or more different sense organs
- (b) has a common root but branches into two nerves to different organs
- (c) contains both sensory and motor fibres
- (d) has two or more roots from different parts of brain

Ans :

MAIN 2022

Contains both sensory and motor fibres.

Thus (c) is correct option.

28. Which of the following parts of the brain continues into spinal cord?

- (a) Medulla oblongata
- (b) Cerebellum
- (c) Pons
- (d) Cerebrum

Ans :

SQP 2017

The medulla oblongata, the bottom-most part of the brain, continues into the spinal cord. It's located in the hindbrain and acts as a coordination pathway for nerve signals traveling to and from the body. The medulla oblongata also helps control vital processes like breathing, heartbeat, and blood pressure, and plays a role in maintaining posture and reflexes.

Thus (a) is correct option.

29. Which one of the following is mainly associated with the maintenance of the posture?

- (a) cerebellum
- (b) cerebrum
- (c) thalamus
- (d) pons

Ans :

COMP 2015

Cerebellum is mainly associated with the maintenance of the posture.

Thus (a) is correct option.

30. The part of the brain that coordinates skeletal muscular movements is

- (a) medulla oblongata
- (b) cerebellum
- (c) cerebrum
- (d) pons

Ans :

MAIN 2011

This is the back of the brain. It coordinates voluntary muscle movements and helps to maintain posture, balance, and equilibrium.

Thus (b) is correct option.

31. The photo receptive cell of the retina sensitive to colour

- (a) rods
- (b) cones
- (c) organ of cortii
- (d) iris

Ans :

COMP 2013

The photoreceptor cells of the retina sensitive to colour are Cones.

Thus (b) is correct option.

32. Which of the following is true about neurilemma?

- (a) The cell membrane around the nerve cell
- (b) A layer of specialised neuroglia around myelin sheath of nerve fibres
- (c) A layer of fatty substance around axon
- (d) The connective tissue around a nerve tract

Ans :

COMP 2021

Neurilemma is a layer of specialized neuroglia around the myelin sheath of nerve fibers.

Thus (b) is correct option.

33. A synapse is found between

- (a) axon terminal and axon terminal
- (b) dendrite and axon terminal
- (c) dendrite and dendrite
- (d) All of the above

Ans :

MAIN 2022

In the central nervous system, a synapse is a small gap at the end of a neuron that allows a signal to flow from one neuron to the next. It is the point where one neuron's axon meets the dendrite of another, allowing the two neurons to communicate.

Thus (c) is correct option.

34. Which of the following helps us to distinguish colours?

- (a) rods
- (b) cones
- (c) rhodopsin
- (d) all of the above

Ans :

MAIN 2019

There are two types of photosensitive cells present in the retina- (a) Rod cells and (b) Cone cells.

Cone cells are cone-shaped and contain iodopsin pigment. Cone cells help us to see objects under bright light. They enable us to identify different colours of objects. Problems in cone cells cause colour blindness.

Thus (b) is correct option.

- 89.** The biological term given to the protective membrane of the brain.
Ans : MAIN 2009
 Meninges
- 90.** The part of the brain that carries impulses from one hemisphere of the cerebellum to the other.
Ans : SQP 2016
 Pons varolii
- 91.** Inflammation of meninges.
Ans : COMP 2010
 Meningitis
- 92.** Protective covering of the brain and spinal cord.
Ans : MAIN 1997
 Meninges
- 93.** The layer of the eyeball that forms the transparent Cornea.
Ans : SQP 2018
 Sclera/sclerotic layer/sclerotic coat/scleroid
- 94.** The membrane covering the brain and spinal cord.
Ans : MAIN 2010
 Meninges
- 95.** The part of autonomic nervous system which prepares the body to prepare for adverse conditions.
Ans : COMP 2017
 Sympathetic
- 96.** A neuro transmitter.
Ans : SQP 2020
 Acetylcholine
- 97.** The cytoplasmic processes of the cell body of a neuron.
Ans : MAIN 2023
 Dendrites
- 98.** A collection of several neurons.
Ans : COMP 2019
 Nerve
- 99.** The tissue that connects two cerebral hemispheres.
Ans : SQP 2022
 Corpus callosum
- 100.** Response to a stimulus Without intervention of the will of an animal.
Ans : MAIN 2020
 Reflex action
- 101.** Most important part of the nervous system.
Ans : COMP 2008
 Brain
- 102.** The part of brain associated with intelligence, sight, hearing and speech.
Ans : COMP 2003
 Cerebral cortex
- 103.** Two types of matter present in brain and spinal cord.
Ans : SQP 2015
 Gray and white matter
- 104.** Wave of electrical disturbance that sweeps over the nerve cell.
Ans : COMP 2011
 Impulse
- 105.** The part of human brain which control body temperature.
Ans : MAIN 2019
 Hypothalamus
- 106.** The nerve that carries impulses from brain to various tissues.
Ans : SQP 2023
 Efferent nerve.
- 107.** The fluid filled in the space between the lens and the retina.
Ans : COMP 2021
 Aqueous humou
- 108.** The soft vascular – middle layer of the eye.
Ans : MAIN 2014
 Choroid
- 109.** The structural and functional unit of nervous system.
Ans : SQP 2012
 Neurons

The vestibular apparatus of the inner ear consists of a utricle, saccule, and three semicircular canals. The balance receptors (hair cells) are present in the utricle, saccule, and ampulla of three semicircular canals. These semicircular canals are arranged right angle to each other. They are filled with a liquid called endolymph. The vestibules and three semicircular canals of the human inner ear maintain body balance.
Thus (d) is correct option.

45. The reflex action is controlled through
- peripheral nervous system
 - autonomic nervous system
 - central nervous system
 - None of the above

Ans : MAIN 2021

The reflex action is governed by the "central nervous system". Reflex actions are under the control of the spinal cord.
Thus (c) is correct option.

46. Which of the following is mainly associated with the maintenance of the posture?
- Cerebellum
 - Cerebrum
 - Thalamus
 - Pons

Ans : COMP 2013

Cerebellum is mainly associated with the maintenance of the posture.
Thus (a) is correct option.

47. In an anatomy class, students learn that the part of the eye responsible for detecting light and color contains specialized cells called rods and cones. The part of the human eye, where rod cells and cone cells are located is the
- cornea
 - retina
 - choroid
 - sclera

Ans : MAIN 2007

Retina is the part of the human eye where rod cells and cone cells are located.
Thus (b) is correct option.

48. A medical student studies the layers of the brain and learns that the innermost membrane protects the brain's surface. Which one of the following is an innermost membrane that covers the brain?
- arachnoid
 - duramater
 - grey matter
 - piamater

Ans :

COMP 2004

The central nervous system (Brain & spinal cord) is covered with three connective tissue layers called meninges. The outermost layer of meninges is the dura mater, the middle layer is the arachnoid mater and the innermost layer is the pia mater. Pia is the most delicate layer of meninges.
Thus (d) is correct option.

49. A teacher explains that the color of the eye, whether blue or black, depends on the part that regulates the light entering the eye. Colour of the eye like blue or black is due to
- sclera
 - choroid
 - iris
 - retina

Ans : SQP 2011

Iris is the pigmented circular diaphragm attached to the ciliary body in front of the lens of the eye. It contains two types of muscles: circular muscles and radial muscles. The pigment of the iris gives colour to the eye such as black, blue, green, brown, etc.
Thus (c) is correct option.

50. An eye surgeon explains to a patient that when an eye is donated, a specific part is commonly grafted to restore vision in those with corneal damage. The part of eye which is grafted in a needy patient from a donated eye is
- cornea
 - conjunctiva
 - choroid
 - ciliary muscles

Ans : COMP 2012

Cornea is the tissue that is most frequently donated and transplanted. It is a contact lens-sized, clear piece of tissue which is present in front of the eye. It is practically impossible to transplant the whole eye, as nerve fibers once cut can never be reconnected.
Thus (a) is correct option.

51. A neuroscience student is learning how signals are transmitted between nerve cells. The professor explains that certain chemicals are released at the synapse to help carry these signals across the junction. Chemicals which are released at the synaptic junction are called
- hormones
 - cerebrospinal fluid
 - neurotransmitters
 - lymph

18. In myopia, the image is formed

- (a) on the retina
- (b) before the retina
- (c) beyond the retina
- (d) on the blind spot

Ans :

MAIN 2018

In nearsightedness, also called myopia, the image of a distant object is formed in front of the retina and not at the retina. This defect arises because the power of the eye is too large due to the decrease in focal length of the crystalline lens.

Thus (b) is correct option.

19. The two hemispheres of the cerebrum are connected by

- (a) corpus callosum
- (b) corpus luteum
- (c) cerebellum
- (d) pons

Ans :

SQP 2023

The two cerebral hemispheres are joined together by the corpus callosum.

Thus (a) is correct option.

20. Which one of the following is responsible for controlling the body temperature ?

- (a) Liver
- (b) Lung
- (c) Spinal cord
- (d) Hypothalamus

Ans :

COMP 2009

Hypothalamus is the part of the brain that controls body temperature. It responds to internal and external stimuli and makes adjustments to keep the body within one or two degrees of 98.6 degrees.

Thus (d) is correct option.

21. A point of contact between two neurons is termed as

- (a) synapsis
- (b) neuro motor junction
- (c) axon
- (d) synapse

Ans :

MAIN 2014

A point of contact between two neurons is termed Synapse.

Thus (d) is correct option.

22. The insulating sheath covering the axon is called

- (a) neurilemma
- (b) plasmalemma
- (c) dura mater
- (d) pia mater

Ans :

COMP 2022

Single axon arises from the cell body and may be enclosed in a myelin sheath and a neurilemma.

Thus (a) is correct option.

23. A reflex arc in man is best described as movement of stimuli from:

- (a) Receptor cell, efferent, relaying neuron, muscles of the body.
- (b) Receptor cell, sensory nerve, relaying neuron, effector muscles.
- (c) Receptor cell, spinal cord, motor neuron, relaying neuron
- (d) Receptor cell, synapse, motor neuron, relaying neuron.

Ans :

SQP 2017

A reflex arc in man is best described as the movement of stimuli from receptor cells, sensory neurons, relaying neurons, and effector's muscles.

Thus (b) is correct option.

24. It is a butterfly-shaped mass present in the spinal cord

- (a) white matter
- (b) grey matter
- (c) dorsal root
- (d) ventral root

Ans :

MAIN 2011

The butterfly-shaped mass present in the spinal cord is grey matter.

Thus (b) is correct option.

25. A reflex arc in man is best described as movement of stimuli from

- (a) receptor cell, efferent nerve, relaying neuron, muscles of the body
- (b) receptor cell, spinal cord, motor neuron, relaying neuron
- (c) receptor cell, sensory neuron, relaying neuron, effector muscles
- (d) receptor cell, synapse, motor neuron, relaying neuron

Ans :

COMP 2019

A reflex arc in man is best described as the movement of stimuli from receptor cells, sensory neurons, relaying neurons, and effector's muscle

Thus (c) is correct option.

26. Which of the following pairs of brain part is not correctly matched with its function?

- (a) Cerebellum: Balance of body
- (b) Cerebrum: Memory
- (c) Medulla oblongata: Controls activities of internal organs
- (d) Pons : Consciousness

Ans :

SQP 2018

The nervous system's main function is to send messages between the brain and the body, regulating thoughts, memory, feelings, movements, balance, and coordination.

Thus (d) is correct option.

59. A student visits the eye doctor with sensitivity to bright light. The doctor explains that the circular opening in the center of the iris controls the amount of light entering the eye. The circular opening in the centre of iris :

- (a) Lens (b) Cornea
(c) Sclera (d) Pupil

Ans :

SQP 2021

How the eyes work - Vision Initiative The circular opening in the center of the iris is called the pupil. The pupil allows light to enter the eye and controls the amount of light that does so. The pupil's size changes to let more or less light in by working with the iris's dilator and sphincter muscles

Thus (d) is correct option.

DIRECTION : Matching Type Questions

60. Suresh studied the structure of the brain and tabulated the functions as follows:

Brain Region	Function on the Body
P	Controls balance and coordination of muscles.
Q	Regulates body temperature and water balance.

Identify the correct pair of brain regions:

- (a) P – Cerebellum, Q – Hypothalamus.
(b) P – Medulla Oblongata, Q – Thalamus.
(c) P – Cerebrum, Q – Hypothalamus.
(d) P – Pons, Q – Cerebrum.

Ans :

SQP 2019

The cerebellum controls balance and muscle coordination, while the hypothalamus regulates body temperature and water balance.

Thus (a) is correct option.

61. Priya studied the sensory receptors in the body and tabulated the details as follows:

Sensory Receptor	Function
P	Detects light intensity and color.
Q	Detects sound vibrations.

Identify the correct pair of sensory receptors:

- (a) P – Rods, Q – Cochlea.
(b) P – Cones, Q – Cochlea.
(c) P – Rods, Q – Organ of Corti.
(d) P – Cones, Q – Semicircular Canal.

Ans :

MAIN 2015

Cones are responsible for detecting light and color, while the cochlea detects sound vibrations in the inner ear.

Thus (b) is correct option.

62. Neha studied different types of nerves and their functions as follows:

Nerve Type	Function
P	Carries impulses from sensory receptors to the brain.
Q	Carries impulses from the brain to muscles and glands.

Identify the correct pair of nerve types:

- (a) P – Motor nerves, Q – Mixed nerves.
(b) P – Sensory nerves, Q – Motor nerves.
(c) P – Mixed nerves, Q – Sensory nerves.
(d) P – Autonomic nerves, Q – Sensory nerves.

Ans :

COMP 2011

Sensory nerves carry signals from sensory receptors to the brain, while motor nerves carry impulses from the brain to muscles and glands.

Thus (b) is correct option.

63. Ravi studied the parts of the ear and their functions as follows:

Ear part	Function
P	Amplifies sound vibrations.
Q	Maintains balance and posture.

Identify the correct pair of ear parts:

- (a) P – Cochlea, Q – Semicircular canals.
(b) P – Auditory Canal, Q – Eustachian Tube.
(c) P – Ear Ossicles, Q – Semicircular canals.
(d) P – Tympanic Membrane, Q – Cochlea.

Ans :

SQP 2007

The ear ossicles (malleus, incus, stapes) amplify sound vibrations, while the semicircular canals are responsible for maintaining balance and posture.

Thus (c) is correct option.

64. Anil studied reflex actions and their significance as follows:

Reflex type	Example
P	Pulling your hand away from a hot object.
Q	Salivating when food is seen.

Identify the correct pair of reflex types:

- (a) P – Conditioned reflex, Q – Unconditioned reflex.
 (b) P – Unconditioned reflex, Q – Conditioned reflex.
 (c) P – Simple reflex, Q – Complex reflex.
 (d) P – Voluntary reflex, Q – Involuntary reflex.

Ans :

MAIN 2002

Pulling the hand away from a hot object is an unconditioned reflex, while salivating at the sight of food is a conditioned reflex learned through experience.

Thus (b) is correct option.

DIRECTION : Conversation Type Question

65. A science teacher asked her students to give two examples of reflex actions.

Raj said: Blinking of eyes and coughing.

Sonu said: Writing and blinking of eyes.

Lata said: Sneezing and pulling hand away from a hot object.

Abhay said: Playing a musical instrument and yawning.

Who were correct?

- (a) Raj and Lata.
 (b) Sonu and Abhay
 (c) Lata and Sonu.
 (d) Abhay and Raj.

Ans :

COMP 2018

Blinking of eyes, coughing, sneezing, and pulling hand away from a hot object are examples of reflex actions. Writing and playing a musical instrument are voluntary actions.

Thus (a) is correct option.

66. A teacher asked her students to identify two organs involved in digestion.

Raj said: Stomach and lungs.

Sonu said: Small intestine and pancreas.

Lata said: Stomach and liver.

Abhay said: Heart and pancreas.

Who were correct?

- (a) Raj and Sonu.
 (b) Sonu and Lata.
 (c) Lata and Abhay.
 (d) Sonu and Abhay.

Ans :

SQP 2014

The stomach, small intestine, pancreas, and liver are organs involved in digestion. Lungs and heart are not directly involved in the digestive process. Thus (b) is correct option.

The teacher asked the class to name two sensory organs.

Raj said: Ears and skin.

Sonu said: Ears and tongue.

Lata said: Nose and liver.

Abhay said: Eyes and nose.

Who were correct?

- (a) Raj and Sonu.
 (b) Lata and Abhay.
 (c) Raj and Abhay.
 (d) Sonu and Abhay.

Ans :

MAIN 2010

Eyes, ears, nose, tongue, and skin are the five main sensory organs. The liver is not a sensory organ.

Thus (d) is correct option.

68. A teacher asked her students to give two examples of types of joints in the human body.

Raj said: Hinge joint and ball and socket joint.

Sonu said: Pivot joint and gliding joint.

Lata said: Fibrous joint and heart.

Abhay said: Ball and socket joint and hinge joint.

Who were correct?

- (a) Raj and Abhay.
 (b) Lata and Sonu.
 (c) Sonu and Raj.
 (d) Lata and Abhay.

Ans :

COMP 2006

Hinge joint, ball and socket joint, pivot joint, and gliding joint are types of joints. The heart is not a joint.

Thus (a) is correct option.

69. A biology teacher asked her students to name two excretory organs in humans.

Raj said: Kidneys and lungs.

Sonu said: Skin and heart.

Lata said: Lungs and liver.

Abhay said: Kidneys and skin.

Who were correct?

- (a) Raj and Abhay.
 (b) Sonu and Lata.
 (c) Lata and Abhay.
 (d) Raj and Sonu.

Ans :

SQP 2002

Kidneys, skin, and lungs are excretory organs. The heart and liver are not directly involved in excretion.
Thus (a) is correct option.

ONE MARK QUESTIONS

DIRECTION : Name the following

- 70.** The eye defect caused due to the shortening of the eyeball from front to back
Ans : SQP 2006
Hypermetropia
- 71.** The region of distinct vision in the eye.
Ans : MAIN 2006
Macula/fovea/yellow spot
- 72.** The tube which connects the cavity of the middle ear with the throat.
Ans : COMP 2004
Eustachian tube
- 73.** The nerve which transmits impulses from the ear to the brain.
Ans : MAIN 2004
Auditory nerve
- 74.** The part of eye responsible for its shape.
Ans : SQP 2003
Vitreous humour
- 75.** Helps to change the focal length of the eye lens
Ans : MAIN 2002
Ciliary muscles
- 76.** The photosensitive pigment present in the rod cells in the retina.
Ans : COMP 1998
Rhodopsin
- 77.** The part of eye responsible for change in the size of the pupil.
Ans : SQP 1997
Iris
- 78.** The ear ossicle in contact with oval window of inner ear.
Ans : MAIN 1997
Stapes
- 79.** Adjustment of eye in order to obtain a clear vision of objects at different distances.
Ans : COMP 1997
Accommodation
- 80.** The opening through which light enters the eye.
Ans : SQP 1998
Pupil
- 81.** The cells of the retina that are sensitive to colour.
Ans : MAIN 1996
Cone
- 82.** The photosensitive pigment present in the rod cells of the retina.
Ans : MAIN 2009
Rhodopsin
- 83.** The internal nutritive layer of the eye which prevents reflection of light.
Ans : SQP 2009
Choroid.
- 84.** Transfers impulses from inner ear to brain.
Ans : COMP 2003
Auditory nerve
- 85.** The part of brain which is concerned with memory.
Ans : COMP 2001
Cerebrum
- 86.** The protective covering of the brain.
Ans : MAIN 2001
Meninges
- 87.** The junction between two nerve cells.
Ans : SQP 2000
Synapse
- 88.** The fluid that is present inside and outside the brain.
Ans : COMP 1998
Cerebrospinal fluid

Ans :

SQP 2004

Chemicals which are released at the synaptic junction are called neurotransmitters. Synapse is junction present between two neurons. Neurotransmitters are released in the synaptic junction and are involved in the transmission of impulses from one neuron to the next. Thus (c) is correct option.

52. During an eye checkup, the doctor explains that a gel-like substance inside the eye helps maintain its shape and ensures proper functioning of the visual system. The structure that keeps the shape of the eyeball
- (a) vitreous humour (b) aqueous humour
(c) vitreous chamber (d) aqueous chamber

Ans :

SQP 2018

The shape of the eyeball is maintained by aqueous humour. The back part (posterior segment) stretches from the lens's front surface to the retina, acting as no-vision zones. Thus (a) is correct option.

53. A student is studying the spinal cord and learns that the ventral root contains neurons that control voluntary movement in the body. The ventral root ganglion of the spinal cord contains cell bodies of the:
- (a) Sensory neuron
(b) Intermediate neuron
(c) Motor neuron
(d) Associated neuron

Ans :

SQP 2002

The ventral root ganglion of the spinal cord contains cell bodies of the motor neuron. Thus (c) is correct option.

54. A biology student is taught that the nervous system is made up of specialized cells responsible for transmitting signals throughout the body. Which of the following is the functional unit of the nervous system?
- (a) Cyton (b) Perikaryon
(c) Axon (d) Neuron

Ans :

MAIN 2023

Neurons are the structural and functional units of the nervous system. The nervous system is made up of billions of neurons. A neuron, also called a nerve cell, is a cell within the body that receives, processes, and transmits information through electrical and chemical signals. Thus (d) is correct option.

55. A biology teacher explains to students that the human ear contains three small bones, known as ossicles, which play a crucial role in hearing. Among these, the smallest one is responsible for transmitting sound vibrations effectively. The smallest ear ossicle is
- (a) malleus (b) Stapes
(c) incus (d) cochlea

Ans :

COMP 2004

The smallest ear ossicle is Stapes
Thus (b) is correct option.

56. A student is learning about reflex actions in biology class. The teacher explains that some reflexes, like sneezing and blinking, are natural, while others, such as salivation at the sight of food, are learned over time. Which of the following is not a natural reflex action?
- (a) Knee-jerk
(b) Blinking of eyes due to strong light
(c) Salivation at the sight of food
(d) Sneezing when any irritant enters the nose

Ans :

SQP 2002

Salivation at the sight of food is not a natural reflex action. It's a conditioned reflex, which means it's a learned response where a stimulus is associated with a consequence. Childhood conditioning contributes to our preference for pleasant foods. Thus (c) is correct option.

57. During an eye examination, the doctor explains to the patient that a clear fluid called aqueous humour is found in the front part of the eye, helping maintain its shape and providing nutrients. Aqueous humour is present between
- (a) lens and retina (b) cornea and lens
(c) cornea and iris (d) iris and lens

Ans :

COMP 2003

The Aqueous humour is present between the cornea and lens. Thus (b) is correct option.

58. An athlete reacts quickly to changes during training. The coach explains that the nervous system helps the body detect and respond to external stimuli. Which of the following can be considered as the function of nervous system?
- (a) Irritability
(b) Conduction of enzymes
(c) To prepare the body against reactions
(d) Receive stimuli

110. Long thread like part of the nerve cell.

Ans :

COMP 2019

Axon

111. The structures present in hind brain.

Ans :

MAIN 2000

Medulla oblongata and cerebellum

112. The defect of eye caused due to uneven curvature of the cornea.

Ans :

COMP 2002

Astigmatism

113. The photosensitive pigment present in the rod cells of retina.

Ans :

SQP 2005

Rhodopsin

114. The structure meant for the constriction of pupil in bright light.

Ans :

MAIN 2013

Iris

115. The structure that has a sensory organ called organ of corti.

Ans :

COMP 2018

Cochlea

116. The muscles which help in alteration of shape of the lens.

Ans :

SQP 2023

Ciliary muscles

117. The bony socket in which the eye is well protected.

Ans :

MAIN 2020

Orbit

118. The nerves which transmit impulses from ear to the brain.

Ans :

SQP 2021

Auditory nerve

119. The inner sensitive coat of eyeball.

Ans :

COMP 2015

Retina

DIRECTION : Give exact location and function of :

120. Pinna

Ans :

COMP 2006

Side of head, collects sound waves.

121. Ear ossicles

Ans :

SQP 2001

Middle ear, increases the magnitude of vibrations.

122. Fovea

Ans :

COMP 2001

Axis of eye in retina, more clear and distinct image is formed.

123. Organ of Corti

Ans :

MAIN 2011

Cochlea (inner ear)

124. Corpus callosum.

Ans :

SQP 2019, 2013

Between two cerebral hemispheres of cerebrum.

125. Myelin sheath.

Ans :

MAIN 2017

Inner sheath around the axon of a neuron.

126. Incus.

Ans :

COMP 2013

Inner ear.

127. Lacrimal gland

Ans :

MAIN 2018

Upper side portion of the orbit of eye

128. Malleus

Ans :

COMP 2018

Middle ear attached to tympanum and incus.

129. Incus.

Ans :

SQP 2019

Between malleus and stapes.

130. Name the three membranous coverings of the human brain.

Ans :

MAIN 2021

Piamater, Arachnoid, Duramater

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(i)	Choroid	Sclerotic
	Absorbs light and prevention of total internal reflection that may cause blurring of image.	Provides and maintains shape of eye ball.
(ii)	Dynamic balance	Static balance
	The sensory cells in cristae of internal ear are concerned with balance while body is in motion.	The sensory cells in ear which are located in Maculae of vestibule are responsible for static balance in human beings by detecting change in the head or body at rest. Concerned with positional balance with respect to gravity.
(iii)	Rod cells	Cone cells
	Rhodospin	Iodospin
(iv)	Myopia	Hypermetropia
	Lens too convex.	Flattened condition of lens.

204. Cerebrum and Spinal cord. (Arrangement of nerve cells).

Ans :

MAIN 2009

Cerebrum	Spinal cord
Outer part contains cell bodies or cyton giving a grayish appearance and inner part contains axon giving white appearance.	Outer part contains axon giving a white appearance and inner part contains cell bodies or cyton giving white appearance.

205. Differentiate between the following on the basis of what is indicated within the brackets :

- Medulla oblongata and Cerebellum (function).
- Cerebrum and Spinal cord (arrangement of cyton and axons of neurons).
- Cerebrum and Cerebellum (function).
- Sensory and Motor neuron (function).

Ans :

COMP 2010, 2005, 2004, 1999, 1997

(i)	Medulla oblongata	Cerebellum
	Concerned with respiratory movements, heart beat and dilation of blood vessels.	Regulates and coordinates muscular contraction and body balance.
(ii)	Cerebrum	Spinal cord
	Cytons outside and axons inside.	Axon outside and cyton inside.
(iii)	Cerebrum	Cerebellum
	Seat of intelligence, memory and control of voluntary activities.	Coordinates muscular activities and maintains body balance.
(iv)	Sensory neuron	Motor neuron
	Conveys impulse from receptors to CNS.	Carries message from CNS to effector.

206. Explain the difference between sensory nerve and a motor nerve.

Ans :

COMP 2005

Sensory nerve	Motor nerve
Dendrites longer than axon and made-up of unipolar neuron.	Axons longer than dendrites and made-up of multipolar neuron.

207. With reference to the functioning of the eye, answer the questions that follow :

- What is meant by power of accommodation of the eye ?
- What is the shape of the lens during (1) near vision (2) distant vision ?
- Name the two structures in the eye responsible for bringing about the change in the shape of the lens.
- Name the cells of the retina and their respective pigments which get activated (1) in the dark (2) in light.

Ans :

SQP 2011

- Abilities of the eye to see objects equally clear from various distances.
1. less convex or too flattened
2. too convex or curved
1. Suspensory ligaments
2. Ciliary body
1. Rod cells ; Rhodopsin
2. Cone cells ; Iodopsin

148. Semicircular canals, malleus, cochlea, utriculus, sacculus.

Ans : MAIN 2004

Parts of inner ear. Malleus.

149. Myopia, hypermetropia, xerophthalmia, astigmatism.

Ans : COMP 2002

Disease of eye. Xerophthalmia.

150. Myopia, cataract, hypermetropia, squint, cretinism.

Ans : SQP 2010

Disorders of eye. Cretinism

151. Malleus, Iris, Stapes, Incus.

Ans : MAIN 2016

Iris, All others are ear ossicles.

152. Aqueous humour, Vitreous humour, Iris, Central canal

Ans : SQP 2017

ODD : Central canal

CATEGORY : Rest are concerned with eyes

153. Dendrites, Medullary sheath, Axon, spinal cord.

Ans : MAIN 2018

Odd term - Spinal cord,

Category - Parts of Neuron

DIRECTION : True or false. Insert a word if false.

154. A reflex action is a spontaneous response to a stimulus.

Ans : COMP 2004

True.

155. All voluntary actions are controlled by the cerebellum.

Ans : SQP 2009

False. All voluntary actions are controlled by the cerebrum.

156. Dilation of the pupil is brought about by the sympathetic nervous system.

Ans : COMP 2010

True.

157. Cranial nerves arise from brain.

Ans : MAIN 2017

True

158. Impulses travel much more rapidly along myelinated nerve.

Ans : SQP 2022

True

159. ANS is completely independent of CNS.

Ans : MAIN 2013

False

160. All nerve fibres arising from the spinal cord are mixed nerves.

Ans : COMP 2009

False

161. The element needed for transmission of nerve impulse is sodium.

Ans : COMP 2016

True

162. Salivation at the smell of food is a natural reflex.

Ans : SQP 2002

False

163. In the spinal cord gray matter is inside.

Ans : MAIN 2004

True

164. Reflex actions involve brain.

Ans : SQP 2008

False

165. Myelin sheath helps in the insulation of axon of neurons.

Ans : COMP 2015

True

166. A convex lens is used for correcting myopia.

Ans : MAIN 2011

False

167. Deafness is caused due to rupturing of pinna.

Ans : SQP 2004

False

131. Name the nerve that transmits impulses to the brain from :

- (a) Ear
(b) Eye

Ans : SQP 2021

- (a) Auditory nerve
(b) Optic nerve

132. Name the kind of lens required to correct Myopia.

Ans : SQP 2017

Concave lens.

133. Name the layer of the eyeball that provide nourishment to the eye.

Ans : SQP 2019

Choroid

DIRECTION : Write in logical sequence :

134. Auditory canal, Organ of Corti, Stapes, Malleus.

Ans : SQP 2025

Auditory canal, Malleus, Stapes, Organ of Corti

135. Ear ossicles, oval window, tympanum, auditory canal, cochlea.

Ans : COMP 2006

Auditory canal, tympanum, ear ossicles, oval window, cochlea.

136. Yellow spot, conjunctiva, pupil, cornea, lens, vitreous humour, aqueous humour.

Ans : MAIN 2005

Conjunctiva, cornea, aqueous humour, pupil, lens, vitreous humour, yellow spot.

137. Pupil, Yellow Spot, Cornea, Lens, Aqueous humour. (path of entry of light into the eye from an object)

Ans : SQP 2010

Cornea, aqueous humour, pupil, lens, yellow spot.

138. Dorsal root ganglion, receptor, effector, ventral root ganglion, associated neuron.

Ans : MAIN 2005

Receptor, dorsal root ganglion, associated neuron, ventral root ganglion, effector

139. Motor neuron, Receptor, Sensory Neuron,

Effector, Association Neuron. (pathway of a nerve impulse)

Ans : MAIN 2010

Receptor, Sensory Neuron, Association of Neuron, Motor Neuron, Effector.

140. Receptor, Spinal cord, Effector, Motor neuron, Sensory neuron.

Ans : SQP 2017

Receptor, Sensory neuron, Spinal cord, Motor neuron, Effector.

141. Cochlea, Malleus, Pinna, Stapes, Incus.

Ans : COMP 2017

Pinna, Malleus, Incus, Stapes, Cochlea.

DIRECTION : Write the category and the odd one out.

142. Coughing, sneezing, blinking, eating.

Ans : MAIN 2003

Category	Odd one
Simple reflex	Eating

143. Corpus luteum, corpus callosum, pons, cerebellum.

Ans : SQP 2003

Part of brain - Corpus luteum

144. Pleura, pericardium, meninges, spinal cord.

Ans : MAIN 2002

Protective coverings - Spinal cord

145. Pons, cerebellum, medulla oblongata, cerebrum.

Ans : SQP 2000

Parts of hind brain-Cerebrum

146. Blinking, Knitting without looking, Smiling, Blushing, Crying.

Ans : COMP 2010

Reflex actions - Smiling

147. Axon, Dendron, Photon, Cyton.

Ans : SQP 2019

Odd term - Photon

Category - Others are parts of nerve cell

Ans :

MAIN 2010

Cerebrospinal fluid

186. The breathing centre of the brain.

Ans :

SQP 2019

Medulla oblongata

187. The lower part of brain which contains reflex centre.

Ans :

COMP 2021

Spinal cord

188. The taste for which the back of tongue is most sensitive.

Ans :

MAIN 2003

Bitter

DIRECTION : State the main functions of the following**189.** Medulla Oblongata

Ans :

SQP 2019

Controls involuntary activities.

190. Ear ossicles

Ans :

COMP 2015

The three ear ossicles form a leverage system which transmit and amplify sound waves from external ear to the internal ear.

191. Eustachian tube

Ans :

SQP 2016

Eustachian tube equalizes air pressure on either side of the ear drum.

192. Eustachian tube.

Ans :

COMP 2016

Act as ventilators to equalize air pressure on the two sides of tympanum.

193. Tears.

Ans :

MAIN 2019

Helps in killing germs, lubricates surface of eye.

194. Optic nerve

Ans :

SQP 2012

Carries impulses from eye to brain

195. Semicircular canal

Ans :

MAIN 2017

Concerned with dynamic equilibrium of the body.

196. Pinna

Ans :

COMP 2021

To receive the vibrations and transmit them to the auditory canal.

197. Eardrum

Ans :

SQP 2023

To receive the vibrations from auditory canal and transmit to ear ossicles.

198. Wax in the ear

Ans :

COMP 2016

To trap dust particles and micro organisms.

199. Eustachian tube

Ans :

MAIN 2022

Helps in equalizing air pressure on either side of the eardrum.

DIRECTION : Mention the exact location of the following.**200.** Semi-circular canals

Ans :

COMP 2017

Internal ear above utricle.

201. Eustachian tube.

Ans :

SQP 2017

Between middle ear and pharynx.

202. Structures Organ of Corti

Ans :

MAIN 2015

Organ of Corti is located in the basilar membrane of scala media of cochlea of ear.

DIRECTION : Differentiate between :

- 203.** (i) Choroid and sclerotic layers of eye (function).
 (ii) Dynamic balance and static balance (Definition).
 (iii) Rod and cone cells (pigment).
 (iv) Myopia and hypermetropia (Cause of defect).

Ans :

COMP 2010, 2006, 2004, 1998

168. Cochlea is concerned with sense of balance.

Ans : MAIN 2010
False

169. Fovea centralis is the area of brightest vision.

Ans : COMP 2010
True

170. The enzyme present in tears which prevents eye infection is lysosomes.

Ans : MAIN 2018
False

171. The fluid in which the membranous labyrinth of inner ear floats is perilymph.

Ans : COMP 2023
True

172. The utricle and saccule are the two sacs that lie in the vestibule of ear.

Ans : SQP 2009
True

173. The semicircular canals are associated with static equilibrium.

Ans : COMP 2019
False

174. In presbyopia loss of elasticity in the lens occurs with ageing.

Ans : MAIN 2021
True

175. James Langley discovered autonomic nervous system.

Ans : SQP 2002
True

DIRECTION : Rewrite and complete the following sentences by inserting the correct word in the space indicated :

176. A fluid that occupies the larger cavity of the eye ball behind the lens is _____

Ans : MAIN 2015
A fluid that occupies the larger cavity of the eye ball behind the lens is vitreous humour.

DIRECTION : The statement given below is incorrect. Rewrite the correct statement by changing the underlined word of the statement.

177. Maintaining balance of the body and coordinating muscular activities is carried out by the cerebrum.

Ans : SQP 2019
Maintaining balance of the body and coordinating muscular activities is carried out by the Cerebellum.

178. Gyri and Sulci are the folds of Cerebellum.

Ans : COMP 2017
Gyri and Sulci are the folds of Cerebrum.

179. The outermost layer of Meninges is Pia mater.

Ans : MAIN 2018
The outermost layer of Meninges is Dura mater

180. Deafness is caused due to the rupturing of the Pinna.

Ans : COMP 2017
Deafness is caused due to rupturing of the eardrum/ tympanum.

181. The part of the eye which can be donated from a clinically dead person is the Retina.

Ans : MAIN 2019
The part of the eye which can be donated from a clinically dead person is cornea.

DIRECTION : Give appropriate biological/technical terms for the following :

182. The antiseptic substance in tears.

Ans : SQP 2017
Lysozymes

183. The fluid present between the layers of meninges.

Ans : COMP 2013
Cerebrospinal fluid

184. The change in an organism resulting due to stimulus.

Ans : MAIN 2013
Response

185. The fluid which fills the central canal and spinal cord.

- 208.** What is meant by power of accommodation ?
Name the muscles of the eye responsible for the same.

Ans :

MAIN 2005

Ability of eye to see objects equally clear from various distance. Ciliary muscles.

- 209.** Define Synapse.

Ans :

SQP 2002

Synapse is the point of contact between terminal branches of axon of one neuron with dendrites of other neuron.

- 210.** Classify the following actions as simple reflex or conditioned reflex :

- Playing a guitar.
- Removing your hand suddenly when pricked by a thorn.
- Applying sudden brakes when a dog crosses the path.
- Blinking of eyelids on exposure to light.
- Tying ones shoe lace.

Ans :

COMP 2009

- Conditioned
- Simple
- Conditioned
- Simple
- Conditioned

- 211.** Select the correct answer to the given statement from the four choices given below each statement:

- The dorsal root ganglion of the spinal cord contains cell bodies of (motor, sensory, intermediate, none of these) neurons.
- The cerebral hemispheres in mammals are connected by (corpus luteum, hypothalamus, pons varolii, corpus callosum).
- A point of contact between two neurons is termed.
 - Synapsis.
 - Neuro-motor junction.
 - Synapse.

Ans :

SQP 2009, 2000

- Sensory
- Corpus callosum
- Synapse

- 212.** How are the cytons and axons placed in the brain and the spinal cord ?

Ans :

MAIN 2019

In brain, outer portion contains cyton which gives a grayish colour hence called as gray matter, while axon is inside.

In spinal cord, cyton is inside forming gray matter and axon is outside forming white matter.

- 213.** Answer briefly :

- What is meant by reflex action ?
- State simple, conditioned reflexes or none for the following :
Sneezing, blushing, contraction of pupil, lifting up a book, knitting without looking, sudden application of brakes without thinking.

Ans :

SQP 2010, 1999

- Reflex action is the immediate, autonomic nerve mediated response to a stimulus produced at the unconscious level without the involvement of brain for thinking.
- Simple, simple, simple, neither of two, conditioned, conditioned.

NODIA

- 214.** Account for the following :

An alcoholic person walks unsteadily when drunk.

Ans :

COMP 2010

An alcoholic person walks unsteadily when drunk because the alcohol affects cerebellum and it is unable to control and coordinate muscular activities properly.

- 215.** Match the items given in Column A with the most appropriate ones in Column B and rewrite the correct matching pairs.

	Column A	Column B
(i)	Cranial nerves	Conditioned reflex
(ii)	Acetylcholine	12 pairs
(iii)	Spinal nerves	Prolactin
(iv)	Sneezing	Neurotransmitter
		18 pairs
		31 pairs
		Natural reflex

Ans :

SQP 2019

	Column A	Column B
(i)	Cranial nerves	12 pairs
(ii)	Acetylcholine	Neurotransmitter
(iii)	Spinal nerves	31 pairs
(iv)	Sneezing	Natural reflex

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	Part of the brain	Functions
1.	Cerebrum	It is the seat of memory, reasoning, thinking, perception, emotions and speech.
2.	Diencephalon	It acts as relay centre for sensory impulses, reflex centre for muscular activities. It contains centre for water balance, blood pressure, body temperature, sleep and hunger.
3.	Midbrain	It relays motor impulses from cerebral cortex to pons and spinal cord and sensory impulses from spinal cord to the hypothalamus.
4.	Cerebellum	It maintains posture equilibrium and muscle tone.
5.	Pons	It transmits impulses from one side of cerebellum to the other side. It also controls breathing.
6.	Medulla oblongata	It contains centre for cardiac, respiratory and vasomotor activities. It also coordinates reflexes for swallowing, coughing, sneezing and vomiting.

250. What is aqueous humour ?

Ans : MAIN 2001

The fluid that fills the space between the cornea and lens of eyeball.

251. Give any two functions of aqueous humour.

Ans : SQP 2003

- (1) Supplies nutrient to cornea and lens.
- (2) Helps to maintain shape of eye.

252. What is vitreous humour ?

Ans : COMP 2019

The colourless jelly that fills the space between lens and retina of eye.

253. What are eyelids ?

Ans : SQP 2022

These are two movable protective folds that cover the anterior surface of eyeball when closed.

254. What is the function of eyelashes ?

Ans : MAIN 2013

The sebaceous gland present at the base of eyelashes (hair follicles) secrete a lubricating fluid and transport it into the follicles.

255. What is cornea ?

Ans : COMP 2008

The modified part of sclera that forms a transparent, fibrous outer layer of eyeball at the anterior region.

256. What is the composition of Iris ?

Ans : SQP 2000

Iris contains both circular and radial muscles along with pigment melanin.

257. Which structure converts vibrations into nerve impulses ?

Ans : MAIN 2003

Organ of corti.

258. What is auditory meatus ?

Ans : COMP 2010

It is a 2.5 cm long canal leading from pinna to eardrum.

259. What is Pinna ?

Ans : MAIN 2014

The visible part of external ear made-up of cartilage.

260. What are the various parts of the external ear ?

Ans : SQP 2019

Pinna, auditory canal and tympanic membrane.

261. What is the soft, hollow, sensory structures present in the internal ear is called as ?

Ans : MAIN 2017

The membranous labyrinth.

233. Injury to medulla oblongata results in sudden death.

Ans : COMP 2017

Medulla oblongata is the centre for involuntary actions such as heart beat, breathing, etc., so injury to it causes sudden death.

234. Brain and spinal cord are considered as the central nervous system.

Ans : SQP 2011

Since they control all activities of body by cranial nerves and spinal nerves.

DIRECTION : Categorize the following reflexes :

235. Knee jerk

Ans : MAIN 2019

Natural

236. Quick closing of eyelids of eye

Ans : COMP 2012

Natural

237. Applying brakes of a car

Ans : SQP 2022

Conditioned

238. Knitting without looking

Ans : MAIN 2023

Conditioned

239. Contraction of Iris of eye

Ans : COMP 2018

Conditioned

240. Sneezing

Ans : SQP 2008

Unconditioned

241. Define brain stem.

Ans : MAIN 2015

The brain stem is the stem like part of brain that connects the cerebral hemispheres with the spinal cord.

242. Name the three membranes (meninges) that protect and surround the brain.

Ans :

MAIN 2017

1. Outer duramater
2. Middle arachnoid
3. Inner piamater

243. State the three parts (sections) of embryonic brain in vertebrates.

Ans :

SQP 2013

1. Forebrain
2. Midbrain
3. Hindbrain

244. What is the average weight of an adult human brain?

Ans :

COMP 2016

1350 to 1400 grams.

245. State the four lobes of cerebral hemispheres.

Ans :

MAIN 2020

1. Frontal
2. Parietal
3. Temporal
4. Occipital

246. What are the three parts of brain stem ?

Ans :

SQP 2014

1. Midbrain
2. Pons varolii
3. Medulla oblongata

247. What is hypothalamus ?

Ans :

MAIN 2018

It is that part of brain which forms the floor of diencephalon made of gray matter.

248. What are the components of reflex arc ?

Ans :

COMP 2011

1. Receptor organ
2. Sensory neuron
3. Associated neuron
4. Motor neuron
5. Effector organ.

249. Make a list of functions of the following parts of the brain :

- | | |
|-------------|----------------------|
| 1. Cerebrum | 2. Diencephalon |
| 3. Midbrain | 4. Cerebellum |
| 5. Pons | 6. Medulla oblongata |

Ans :

SQP 2014

- 216.** Mention two functions of the choroids coat in the eye.

Ans : COMP 1997

Choroid forms nutritive layer of eye. Contains iris. It prevents reflection of light inside the eye.

- 217.** Differentiate on the basis of what is mentioned within brackets : Rod cells and cone cells (pigment)

Ans : SQP 2016

Rod cells contain rhodopsin pigment whereas cone cells contain iodopsin pigment.

- 218.** Briefly explain Power of accommodation.

Ans : MAIN 2016

Ability of the eye to see the object equally clear from various distances is called Power of accommodation.

- 219.** Give biological explanations for the following : We should not put sharp objects into our ears.

Ans : MAIN 2018

Tympanum is very delicate and sharp object may rupture them leading to deafness.

DIRECTION : Fill up the blanks with suitable words:

- 220.** _____ receive information from sensory receptors and transmit it to the central nervous system.

Ans : COMP 2021

Sensory neurons

- 221.** Nervous system has two main functions to initiate and co-ordinate response to the _____ and to maintain _____.

Ans : SQP 2014

External environment ; internal homeostasis

- 222.** The cavities of brain are called _____.

Ans : MAIN 2022

Ventricles

- 223.** Conditioned reflex can be exemplified by _____.

Ans : COMP 2020

Pulling away hand on touching a hot plate

- 224.** _____ enables us to see in dimlight. (cones / rods)

Ans :

SQP 2000

Rods

- 225.** Point of no vision in the retina of eye is _____ (yellow spot/blind spot).

Ans : MAIN 2010

Blind spot

- 226.** Capacity of eye to focus at different distances is called power of _____ (accommodation/supervision).

Ans : SQP 2005

Accommodation

- 227.** The three small bones in the middle ear are collectively called _____ (occipitals / ossicles).

Ans : COMP 2002

Ossicles

- 228.** In _____ a person cannot distinguish between red and green colour (colour-blindness/nightblindness).

Ans : MAIN 2009

Colourblindness

- 229.** _____ is the largest part of brain.

Ans : SQP 2012

Cerebrum

DIRECTION : Give logical reasons for the following :

- 230.** Old people are unable to perceive taste easily.

Ans : MAIN 2010

Old people are unable to perceive taste easily due to weakening of olfactory sensation and taste buds.

- 231.** The outer portion of the brain appears gray while inner portion white.

Ans : SQP 2013

The outer portion of brain is made up of gray matter (cytons) while the inner portion consists of white matter (axons).

- 232.** The brain is ordinarily free from shock.

Ans : COMP 2019

Brain is protected by cranium and a fluid (cerebrospinal fluid) is present in between the meninges. It acts as a shock absorber.

- 262.** Name the central hole of the iris through which light enters the eye.

Ans : SQP 2009
Pupil

- 263.** What are the two main defects of eye ?

Ans : COMP 2016
Myopia and hypermetropia.

- 264.** What is organ of corti ?

Ans : SQP 2022
It is an elongated spiral structure that runs through the entire length of cochlea.

- 265.** What is lens ?

Ans : MAIN 2007
It is a crystalline, transparent, biconvex body held by fibres called suspensory ligament that support it.

TWO MARKS QUESTIONS

- 266.** Chris was watching the display of fireworks in the sky.



- (a) Trace the path of the light rays using the following terms:
Fovea, Lens, Conjunctiva, Pupil, Cornea
(b) Name the nerve that carries the impulse for vision to the brain.

Ans : SQP 2025
(a) Conjunctiva, Cornea, Pupil, Lens, Fovea
(b) Optic nerve.

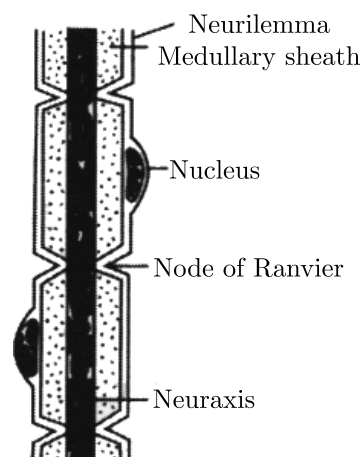
- 267.** Which parts of the ear are responsible for

- (i) Static equilibrium?
(ii) Dynamic equilibrium?

Ans : MAIN 2024
(i) Static Equilibrium: This is maintained by the utricle and saccule, which are parts of the vestibule in the inner ear.
(ii) Dynamic Equilibrium: This is maintained by the semicircular canals, also located in the inner ear.

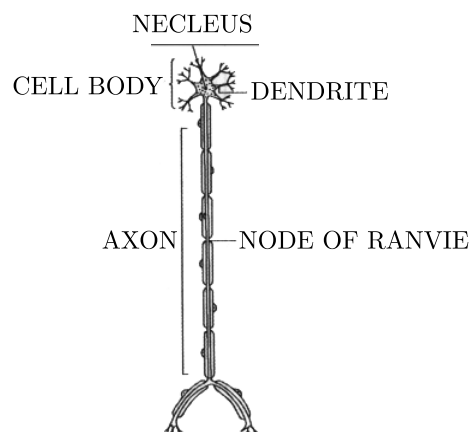
- 268.** Draw a labelled diagram of a myelinated neuron.

Ans : COMP 2005
A myelinated neuron



- 269.** Draw a neat diagram of a Neuron and label any two parts.

Ans : COMP 2021



A NERVE CELL (NEURON)

- 270.** Answer the following questions briefly :

- (i) Which part of the human ear gives 'Dynamic balance' and 'Static balance' to the body ?

The sensory cells in ear which are located in maculae of vestibule are responsible for static balance in human beings.

286. State briefly :

- (i) Myopia (symptom and cause)
- (ii) Tympanum (location and function)
- (iii) Yellow spot (location and importance)

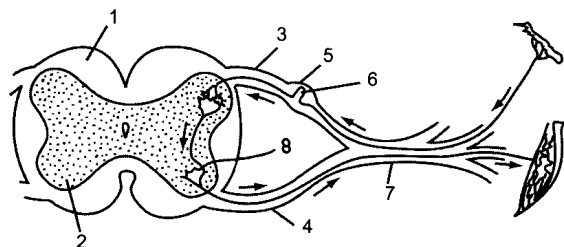
Ans :

SQP 1997, 1995

- (i) **Symptom :** Near vision clear while distinct vision blurred.
Cause : Image of distant objects are formed in front of retina because of eyeball becomes too long or when eye lens is too convex and hence focal length is shortened.
- (ii) **Location :** Between external and middle ear.
Function : Sound waves from outside cause tympanum to vibrate which are ultimately transmitted across the middle ear and produce sound.
- (iii) **Location :** At the back of eye almost at the centre of the horizontal axis of the eyeball.
Importance : Place of best focus of the rays of light that enter so a very clear image is seen in the normal eye.

287. The diagram given below represents the spinal cord of a mammal seen in a transverse section together with the nerves. Study the same and then answer the following questions:

- (i) Label the parts 1- 8 indicated by guidelines.



- (ii) What do the arrows indicate ? What is the pathway indicated termed ?
- (iii) What type of nerve is shown in the diagram.

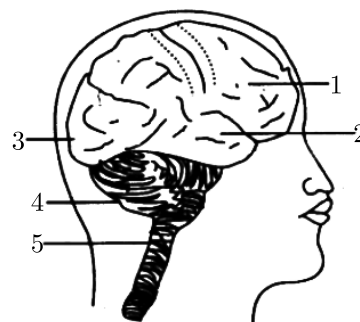
Ans :

SQP 1997

- (i) 1. White matter,
2. Gray matter,
3. Dorsal root,
4. Ventral root,
5. Dorsal ganglion,
6. Sensory neuron,
7. Spinal/ Motor nerve,
8. Synapse.

- (ii) Arrows indicate the direction of the impulse from receptor in the skin to spinal cord and then to the effector or muscle. Pathway indicated is termed as Reflex action.
- (iii) Spinal nerve.

288.



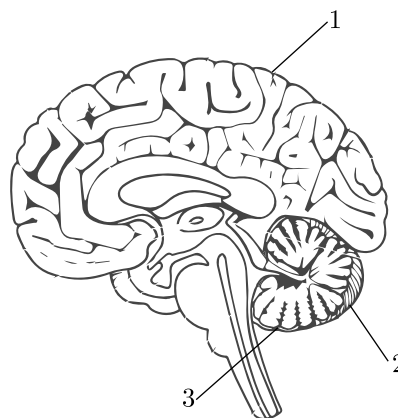
- I. What handicaps would result from :
(i) damage to part numbered 3 ?
(ii) damage to part numbered 4 ?
- II. Mention one main function of each of the parts numbered 1, 2 and 5.

Ans :

SQP 2014

- I. (i) Visual sensation can be affected.
(ii) An individual can lose the balance of the body and coordination of muscular activities.
- II. 1 → It is concerned with the thinking.
2 → Memory and intelligence.
5 → Medulla oblongata controls heartbeat, respiration and blood pressure.

289. The diagram given below is that of a human brain. Answer the questions that follow :



- (a) Label the parts numbered 2 and 3.
- (b) State any one function of the part numbered 1.



- Name the part of the membranous labyrinth responsible for this dizziness.
- Give a suitable reason for your answer.
- Mention the nerve that carries the impulse for dizziness to the brain.

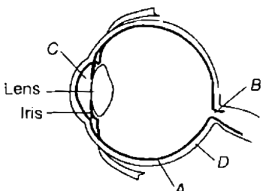
Ans :

SQP 2025

- Semicircular canals
- The fluid in the semi circular canals continue to spin for a short time even after the dancer stops spinning. This results in dizziness
- Auditory nerve.

- 282.** Given below is a cross section of the human eye. Match the structures marked (a) to (e) with their correct functions:

Example: (f) - 6. Holds the lens in position

Cross section of Human Eye		Functions
	1.	Protects retina
	2.	Regulates the size of the pupil
	3.	Alters the shape of the lens
	4.	Keeps the lens moist
	5.	Transmits nerve impulses to brain
	6.	Holds the lens in position

Ans :

SQP 2025

- (a) 5 (b) 1 (c) 2 (d) 4 (e) 3

- 283.** A teacher drew the diagram of heart on the blackboard and told the students to copy it in their notebooks. Mahesh couldn't see the diagram clearly as it appeared blurred to him.

- Name the defect of the eye Mahesh is suffering from.
- Where is the image formed in this defect?
- Mahesh consults an eye doctor and is prescribed suitable lenses to correct the defect. Which type of lens do his spectacles have?

Ans :

MAIN 2024

- Mahesh is suffering from the defect of the eye known as myopia or nearsightedness.
- In myopia, the image is formed in front of the retina, causing distant objects to appear blurred.
- Mahesh's spectacles has concave lenses to correct the defect of myopia.

- 284.** Give the technical term :

- An eye defect in which the cornea becomes uneven.
- The photosensitive pigment present in the cone cells of the retina.
- The fluid present in the anterior part in front of the eye lens.

Ans :

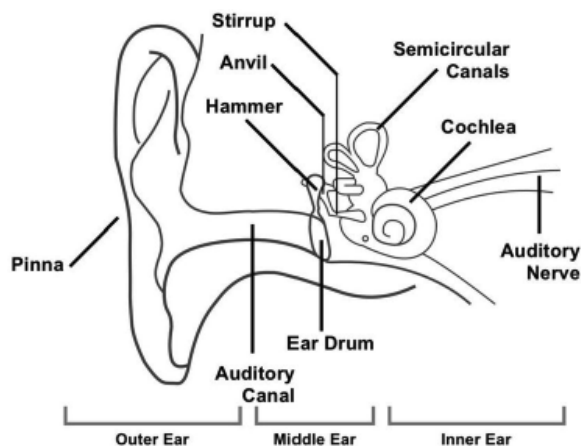
MAIN 2010

- Astigmatism
- Iodopsin
- Aqueous humour

- 285.** Draw a labelled diagram of the inner ear. Name the part of the inner ear that is responsible for static balance in human beings.

Ans :

COMP 2005



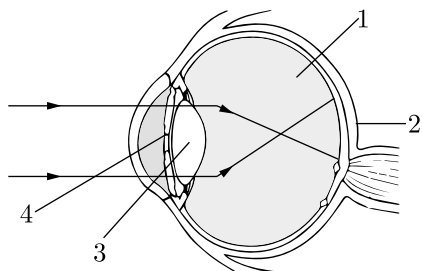
- (i) Name the phenomenon that is depicted in the diagram. Define the phenomenon.
- (ii) Give the technical term for the point of contact between the two nerve cells.
- (iii) Name the parts numbered 1, 2 and 3.
- (iv) How does the arrangement of neurons in the spinal cord differ from that of the brain ?
- (v) Mention two ways by which the spinal cord is protected in our body.

Ans :

MAIN 2018

- (i) Reflex action is a spontaneous, involuntary and automatic response to any stimulus without the involvement of brain.
- (ii) Synapse
- (iii) 1. Sensory neuron
2. Motor neuron
3. Gray matter
- (iv) In brain, gray matter is outside and white matter is inside.
In spinal cord, gray matter is inside and white matter is outside
- (v) Meninges and Vertebral column.

302. Given below is a diagram depicting a defect of the human eye. Study the same and then answer the questions that follow :



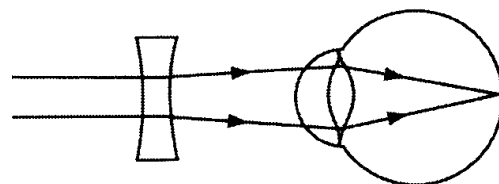
- (i) Name the defect shown in the diagram.
- (ii) Give two possible reasons for this defect of the eye in human beings.
- (iii) Name the parts labelled 1 to 4.
- (iv) Name the type of lens used to correct this eye defect.
- (v) Draw a labelled diagram to show how the above mentioned defect is rectified using the lens named above.

Ans :

COMP 2004

- (i) Myopia.
- (ii) Two possible reasons for Myopia are :
(a) eyeball is lengthened from front to back.
(b) lens is too curved.
- (iii) (1) Vitreous humour
(2) Yellow spot

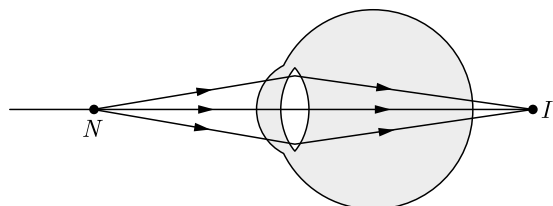
- (3) Lens
- (4) Pupil
- (iv) Concave lens is used to correct this eye defect.
- (v)



A concave lens diverges the light rays as a result, the image is now formed on the retina.

303. The diagram given below represents a defect of vision of the human eye :

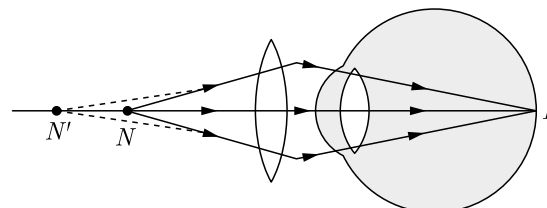
- (i) Name the defect.
- (ii) What is the effect of this defect on man ?
- (iii) Mention two causes for the defect.
- (iv) How can this defect be rectified ?
- (v) Draw a neat labelled diagram to show how this defect can be rectified.
- (vi) What is the nature of this image that falls on the retina of a normal eye ?



Ans :

MAIN 2004

- (i) Hypermetropia.
- (ii) The person cannot see near objects, i.e., only distant objects can be viewed.
- (iii) (1) The lens is flattened.
(2) The eye ball is shortened from front to back.
- (iv) This defect can be rectified by biconvex lens.



- (v) The image that fall on the retina of a normal eye is inverted, real and diminished.

304. The diagram given below is an external view of the human brain. Study the same and answer the questions that follow :

Ans :

SQP 2021

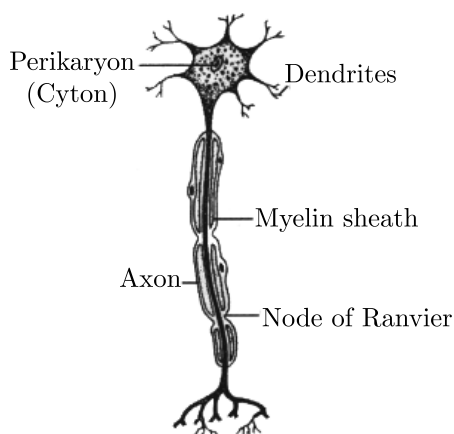
- (a) 2 - Cerebellum
3 - (wrongly marked in the diagram)
- (b) Controls all voluntary action.

- 290.** (i) Draw a well labelled diagram of a Neuron showing the following parts : Perikaryon, Dendrites, Axon, Node of Ranvier and Myelin sheath.
- (ii) State the function of sensory neuron and a motor neuron.
- (iii) What is a nerve made-up of ?

Ans :

COMP 2015

(i)



- (ii) Sensory Neuron : These carry sensory impulses from sense organs to CNS.
Motor Neuron : These carry motor impulses from CNS to effectors i.e., muscles and glands.
- (iii) A nerve is formed of a bundle of nerve fibres (axons) enclosed in a tubular sheath.

- 291.** During a street fight between two individuals, mention the effects on the following organs by the autonomous nervous system, in the table given below : (one has been done for you as an example)

Organ	Sympathetic system	Parasympathetic system
e.g., Lungs	Dilates bronchi and bronchioles	Constricts bronchi and bronchioles
1. Heart		
2. Pupil of the eye		
3. Salivary gland		

Ans :

COMP 2023

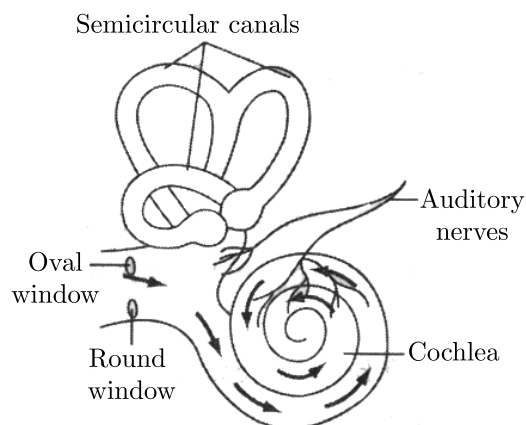
Organ	Sympathetic system	Parasympathetic system
1. Heart	increases heartbeat	Decreases heartbeat
2. Pupil of the eye	Dilates	Constricts
3. Salivary gland	Decreases secretion of saliva	Increases secretion of saliva

- 292.** Draw a labelled diagram of the inner ear.

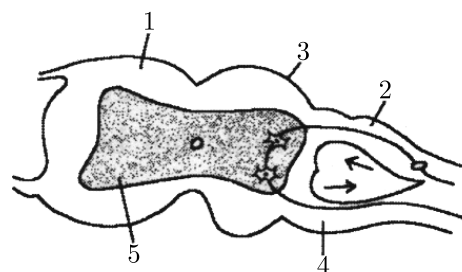
Ans :

COMP 2014

The labelled diagram of the inner ear is draw below:



- 293.** The figure below shows a diagrammatic representation of a certain phenomenon pertaining to nervous system.

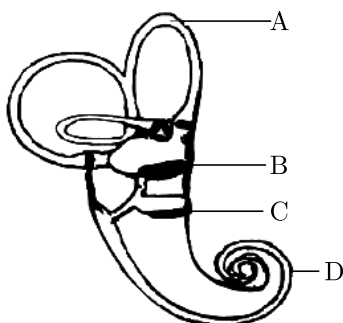


- (i) Label the part 1 to 5.
- (ii) What phenomenon does the diagram represent?
- (iii) Name the parts not shown in the diagram that should be included to complete the pathway of the phenomenon.

Ans :

MAIN 2004

- (i) 1. White matter



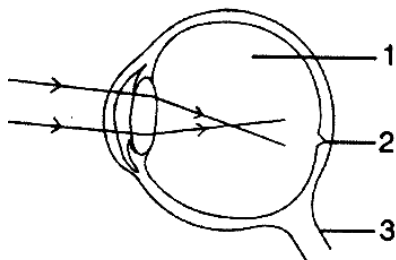
- Name the parts labelled A, B, C and D.
- Name the part of the ear responsible for transmitting impulses to the brain.
- Name the part labelled above which is responsible for :
 - Static equilibrium
 - Dynamic equilibrium
 - Hearing
- Name the audio receptor cells which pick up vibrations.
- Name the fluid present in the inner ear.

Ans :

COMP 2009

- A → Semi circular canal
B → Utriculus
C → Sacculus
D → Cochlea
- Cochlea
- (1) Utriculus and sacculus
(2) Semi circular canal
(3) Cochlea
- Sensory hair cells of organ of corti.
- Perilymph and endolymph.

308. Given is a diagram depicting a defect of the human eye. Study the same and then answer the questions that follow :

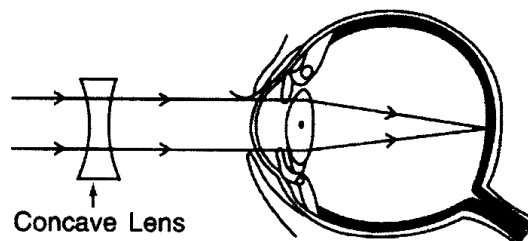


- Name the defect show in the diagram
- Name the parts labelled 1, 2 and 3.
- Give two possible reasons for this eye defect.
- Draw a labelled diagram to show how the above mentioned defect is rectified.

Ans :

SQP 2009

- Myopia/short sightedness
- 1 → Vitreous humour
2 → Yellow spot / fovea centralis
3 → Optic nerve
- (1) Lens become too curved
(2) Eyeball lengthened from front to back.
-

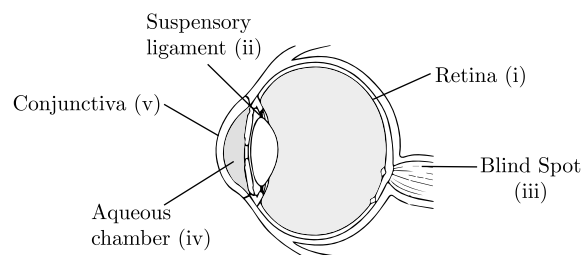


309. Draw a diagram of the human eye as seen in a vertical section and label the parts which suits the following descriptions relating to the :

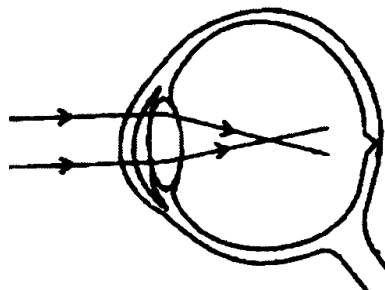
- photosensitive layer of the eye.
- structure which is responsible for holding the eye lens in its position.
- structure which maintains the shape of the eye ball and the area of no vision.
- anterior chamber seen in front of the eye lens.
- outer most transparent layer seen in front of the eye ball.

Ans :

MAIN 2013



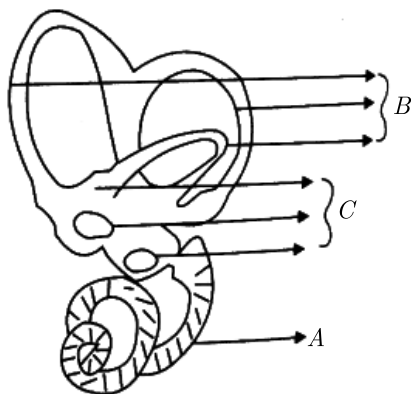
310. Given below is a diagram depicting a defect of the human eye, study the same and then answer the questions that follow :



movements on both sides of the body.

- (iii) The three protective membranes are Piamater, Arachnoid membrane and duramater.
- (iv) The basic unit of the brain is neuron/nerve cell.

298. Given is the diagram of a part of the human ear. Study the same and then answer the questions that follow :



- (i) Give the biological term for Malleus, Incus and Stapes.
- (ii) Name the parts labelled A, B and C in the diagram.
- (iii) State the functions of the parts labelled 'A' and 'B'.
- (iv) Name the audio receptor region present in the part labelled 'A'.

Ans :

SQP 2003

- (i) Ear Ossicles.
- (ii) (A) Cochlea,
(B) Semi-circular canals,
(C) Vestibular apparatus.
- (iii) (A) Hearing
(B) Dynamic balancing.
- (iv) Organ of Corti.

299. With reference to the human ear, answer the questions that follow :

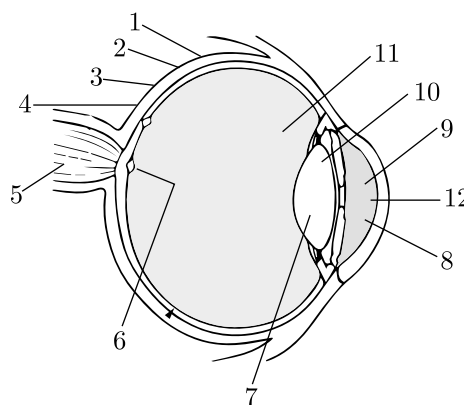
- (i) Give the technical term for the structure found in the inner ear.
- (ii) Name the three small bones present in the middle ear. What is the biological term for them collectively ?
- (iii) Name the part of the ear associated with (1) static balance (2) hearing (3) dynamic balance.
- (iv) Name the nerve, which transmits messages from the ear to the brain.

Ans :

COMP 2011

- (i) Membranous labyrinth which consists of :
 - (a) Semicircular ducts
 - (b) Vestibule
 - (c) Cochlear duct
- (ii) Three bones are malleus, incus and stapes, its biological term is ear ossicles.
- (iii) 1. Maculae
2. Organs of Corti
3. Cristae present in the ampullae of semicircular ducts.
- (iv) Auditory nerve.

300. The diagram given below represents the cross-section of the human eye :



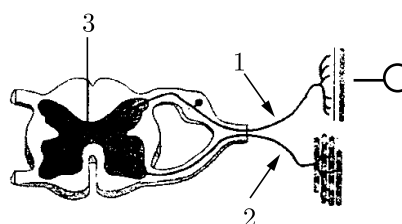
- (i) Name the parts labelled 1 to 12.
- (ii) What is the function of the part marked '10'?
- (iii) What would happen if part '5' is damaged or cut ?

Ans :

SQP 2000, 1996

- (i) (1) Sclerotic, (2) Choroid, (3) Retina, (4) Yellow spot, (5) Optic nerve, (6) Blind spot, (7) Lens, (8) Aqueous humour, (9) Pupil (10) Iris, (11) Vitreous humour, (12) Cornea.
- (ii) It regulates the light entering the eye to avoid damage to the cells of the retina.
- (iii) If '5' is damaged or cut, a person would not be able to see because the sensation would not reach the human brain.

301. The diagram given below shows the internal structure of a spinal cord depicting a phenomenon. Study the diagram and answer the questions :



2. Dorsal root
 3. Spinal cord
 4. Ventral root
 5. Gray matter
- (ii) Reflex arc
- (iii) Receptor and effector must be shown.

294. At the start of a race, athletes react to a starter gun. This reaction involves a number of events.

- (a) In the box below, put the following events in correct order. The first one has been done for you.

1. Co-ordination by brain
2. Detection by receptors
3. Stimulus
4. Response
5. Effector change

3				
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- (b) Write one difference between voluntary and reflex action.
- (c) Why are reflex actions so important to living beings ?

Ans :

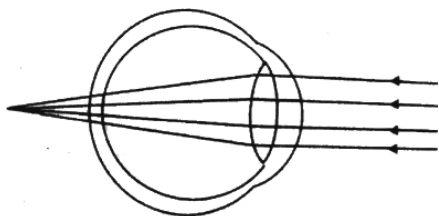
MAIN 2019

- (a)

3	2	1	5	4
---	---	---	---	---

- (b) Reflex actions are faster while voluntary actions are slower.
- (c) Because fast reactions help to survive from predators.

295. Study the diagram given below and answer the questions that follow :



- (a) Identify the defect of the eye by mentioning the technical term.
- (b) Mention one reason for this defect.
- (c) Name the type of lens used to correct this defect.

Ans :

Sem II, 2021

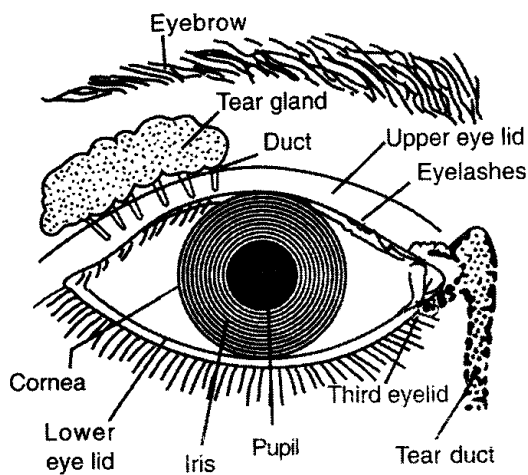
- (a) Hypermetropia/Hyperopia
- (b) Eyeball shortened from front to back
- (c) Convex lens

FIVE MARKS QUESTIONS

296. Draw a labelled diagram of the front-view of the human eye.

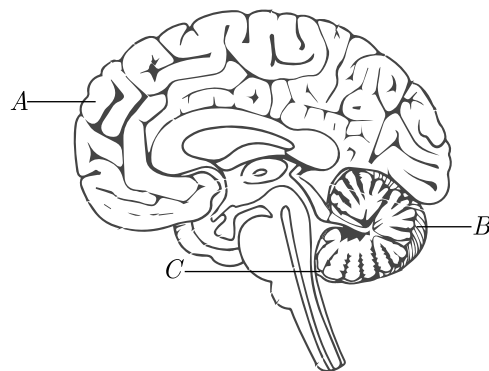
Ans :

COMP 1990



297. The diagram shows a section of the human brain. Answer the questions that follow :

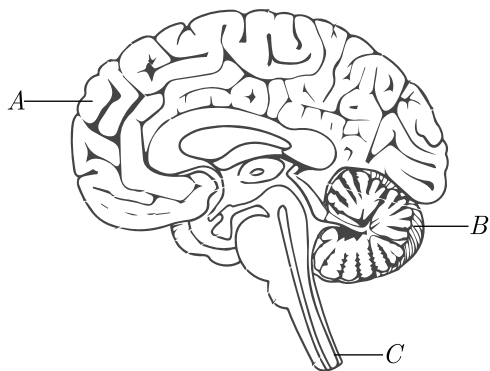
- (i) Name the parts labelled A, B and C.
- (ii) Give the main function of each of the parts A, B and C.
- (iii) Name the three protective membranes covering the brain.
- (iv) Name the basic unit of the brain.



Ans :

SQP 2009

- (i) A → Cerebrum B → Cerebellum C → Pons varolii
- (ii) A → Seat of intelligence, consciousness and will power.
B → Maintains balance or equilibrium and co-ordinate muscular activities.
C → Carries impulses from one hemisphere of cerebellum to other and co-ordinates muscular



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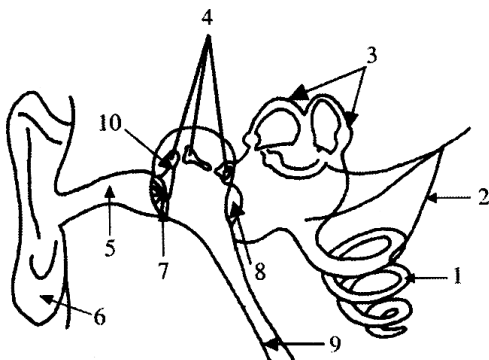
- (i) Name the parts labelled A, B and C in the diagram.
- (ii) State the main functions of the parts labelled A and B.
- (iii) What are the structural and functional units of the brain ? How are the parts of these units arranged in A and C ?
- (iv) Mention the collective term for the membranes covering the brain.
- (v) What is the function of Cerebrospinal fluid ?

Ans :

MAIN 2017

- (i) A. Cerebrum
B. Cerebellum
C. Spinal cord
- (ii) A – It is the seat of memory, will power, emotions, experience, intelligence and controls all voluntary actions of the body.
B – Maintains balance of the body.
- (iii) Neuron/Nerve cell.
In A gray matter is outside and white matter is inside while in C gray matter is inside and white matter is outside.
- (iv) Meninges.
- (v) It serves as shock absorbing medium. Protects brain and the rest of CNS against jerk and jolts. It maintains constant pressure in and around the brain.

305. The given diagram refers to the ear of a mammal.



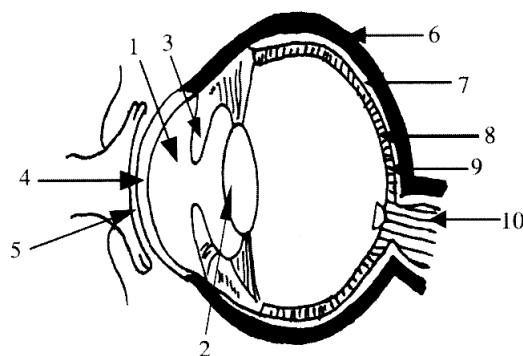
- I. Label the parts 1 to 10 which the guidelines point.
- II. Which structure :
 - (i) Converts sound waves into mechanical vibrations ?
 - (ii) Converts vibrations into nerve impulses ?
 - (iii) Responds to change in position ?
 - (iv) Transmits impulses to the brain ?
 - (v) Equalizes atmospheric pressure and pressure in the ear ?

Ans :

COMP 1999

- I.
 1. Cochlea
 2. Auditory nerve
 3. Semi-circular canals
 4. Ear ossicles
 5. Auditory canal
 6. Pinna
 7. Ear drum
 8. Oval window or fenestra ovalis.
 9. Eustachian tube
 10. Malleus or hammer
- II.
 - (i) Ear drum.
 - (ii) Cochlea.
 - (iii) Semi-circular canals.
 - (iv) Auditory nerve.
 - (v) Eustachian tube.

306. The diagram given below refers to the vertical section of the eye of a mammal. Label the parts 1 to 10 to which the guidelines point.



Ans :

SQP 2011

1. Aqueous humour, 2. Lens, 3. Iris, 4. Cornea, 5. Conjunctiva, 6. Sclera, 7. Choroid, 8. Retina, 9. Yellow spot, 10. Optic nerve.

307. The diagram below represents the structure found in the inner ear. Study the same and then answer the questions that follow :

- (ii) Explain how the human eye adapts itself to bright light and dim light.

Ans :

MAIN 2019

- (i) Dynamic balance - semicircular canal Static balance - utricle and saccule (vestibule)
- (ii) When a person moves from dark lighted area to brightly lighted area, visual purple of rods is bleached reducing their sensitivity and pupil constricts to reduce the amount of light entering eyes. This is light adaptation. When a person moves from brightly lighted area to dark area, visual purple of rods which were earlier broken due to bright light regenerates and pupil dilates to allow more light to enter. This is dark adaptation.

- 271.** Give scientific reason for the Injury to medulla oblongata leads to death.

Ans :

MAIN 2016

Injury to medulla oblongata may lead to death as various vital centres such as cardiac centre, respiratory centres etc. are located in the medulla oblongata and injury to any such centre may prove fatal.

- 272.** Briefly explain the term Reflex action

Ans :

SQP 2016

Reflex action is the spontaneous, automatic and stereotyped response to stimuli without consulting the will power.

- 273.** Briefly explain the term Synapse.

Ans :

MAIN 2016

Close proximity between the terminal arborization of axon of one neuron and dendrons of another neuron without any physical contact is called synapse.

- 274.** Define the term Synapse. How are Cytons and Axons of neurons placed in the Cerebrum ?

Ans :

COMP 2021

Point of contact between terminal branches of axon of a neuron with dendrites of another neuron separated by a fine gap. Outer part of cerebrum consists of cyton and inner part has axon.

- 275.** What is a reflex action ? Name the two types of reflexes.

Ans :

MAIN 2021

Spontaneous, involuntary and automatic response

to any stimulus without the involvement of brain. Two types of Reflexes are – Natural and conditioned reflexes.

- 276.** Why does one feel blinded for a short while on coming out of a dark room ?

Ans :

SQP 2009

One feels blinded for a short while on coming out of a dark room because of the formation of iodopsin pigment by cone cells that was disintegrated in the dark and bleaching of rhodopsin pigment of rod cells in light.

- 277.** Explain the term Cataract.

Ans :

MAIN 2010

Cataract : It is a condition in which the lens turns opaque and the vision is cut down even to total blindness. It can be corrected by implanting a small plastic lens behind or in front of the iris or surgically removing the lens and using spectacle with highly convex lenses.

- 278.** State the main function of the following :

- (i) Yellow spot
(ii) Vitreous humour

Ans :

COMP 2011

- (i) Bright vision of normal eye.
(ii) Maintains the shape of eyeball, protects the retina and its nerve endings.

- 279.** What is accommodation of the eye ?

Ans :

MAIN 2010

The ability of an eye to focus on nearby and far objects clearly is called power of accommodation. It is brought about by change of convexity of the lens.

- 280.** What is conjunctiva and what is its function ?

Ans :

SQP 2018

The mucous epithelial membrane that lines the eyelids is called conjunctiva. It protects the surface of the eye.

THREE MARKS QUESTIONS

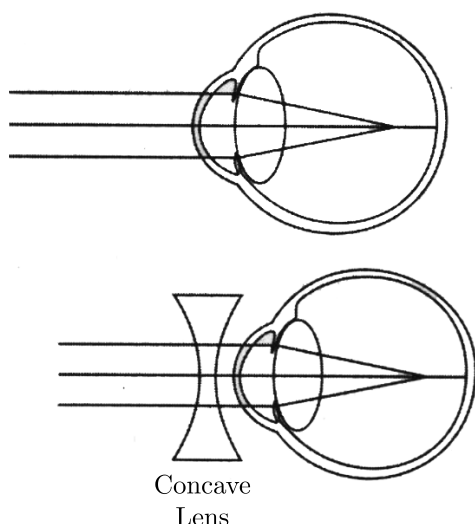
- 281.** Kathak is an Indian classical dance which involves a lot of spinning by the dancers. The learners of this dance experience dizziness in the beginning while spinning.

- (i) Name the defect shown in the diagram.
- (ii) What are the two possible reasons that cause this defect?
- (iii) Name the type of lens used to correct this defect.
- (iv) With the help of a diagram show how the defect shown above is rectified using a suitable lens.

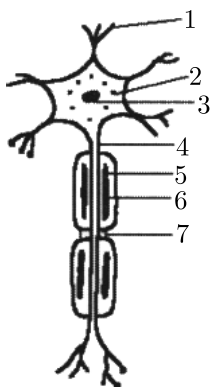
Ans :

COMP 2016

- (i) Myopia/Near-sightedness
- (ii) Excessive thickening of cornea and increase in the length of eye ball from front to back.
- (iii) Concave lens
- (iv)



- 311.** The diagram shows a neuron. Study the diagram and then answer the questions that follow :



- (i) Label the parts 1 to 7.
- (ii) State the function of part 4 and 7.
- (iii) What is the name given to the junction between two neurons?
- (iv) Define impulse.

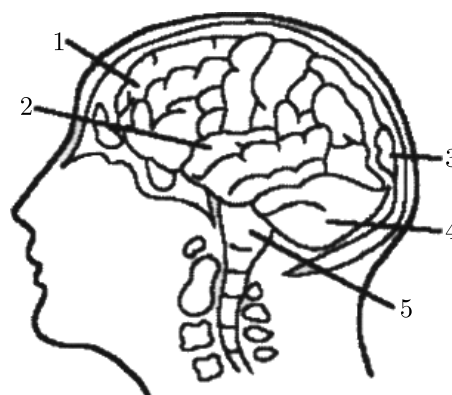
Ans :

COMP 2021

- (i)
 1. Dendrite
 2. Nissl's granule
 3. Nucleus
 4. Axon
 5. Neurilemma
 6. Myelin sheath
 7. Node of Ranvier
- (ii) 4 (Axon) - Helps in transmission of nerve impulse from cyton to axon endings.
7 (Node of Ranvier) - Provides mechanical support to the structure of neuron.
- (iii) Synapse
- (iv) Impulse is a wave of electrical disturbance on the surface of axon.

- 312.** The diagram below is that of a human brain. Study the diagram carefully and then answer the questions that follow :

- (i) Label the parts numbered 1 to 5.



- (ii) What handicaps would result from :
 - (a) Damage to part numbered 3 ?
 - (b) Damage to part numbered 4 ?
- (iii) What are the functions of parts numbered 1, 2 and 5 ?

Ans :

MAIN 2014

- (i)
 1. frontal lobe of cerebrum
 2. temporal lobe of cerebrum
 3. occipital lobe of cerebrum
 4. cerebellum
 5. medulla oblongata
- (ii)
 - (a) It will result in failure of vision.
 - (b) Person would not be able to maintain body balance, posture and muscular co-ordination would be lost.
- (iii) Part number 1 is the seat of intelligence, memory and centre of voluntary activities.
Part number 2 controls the hearing.
Part number 5 controls and regulates cardiac and vasomotor activities.

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CHAPTER 10

THE ENDOCRINE SYSTEM

SUMMARY

1. ENDOCRINE SYSTEM

Endocrine glands control, communicate, coordinate and integrate various functions of all body organs by secretion of hormones and collectively constitute the endocrine system. The science concerned with the structure of endocrine glands, diagnosis and treatment of disorders of endocrine glands is known as endocrinology. Thomas Edison is called as Father of endocrinology. Secretin was the first hormone to be discovered by William M Bayliss and Ernest H Starling and the name hormone was coined by Starling.

In human body, there are two types of glands – exocrine (gland with duct) and endocrine (ductless gland).

Endocrine (ductless) glands are such glands which secrete hormones which are extremely important for regulation of body activities. The hormones are released directly into the blood stream as there are no ducts in endocrine glands hence called ductless gland.

The activities in our body are highly complex and they need to be so regulated that every activity

takes place at proper time and in a correct sequence.

The hormones are secretions from specific cells or glands in the body and are carried to all parts by blood.

1.1 Chemical Nature of Hormones

Hormones are organic compounds of diverse nature. Chemically hormones may be proteinaceous (FSH, LH, TSH, etc), peptides (ACTH, oxytocin, vasopressin, etc.), steroids (sex hormones) or amino acid derivatives (thyroxine, epinephrine, etc.).

1.2 Endocrine Glands in Humans

The mammalian endocrine system consists of the following endocrine glands :

1. Pituitary gland – associated with brain.
2. Thyroid gland – associated with pharynx (neck).
3. Adrenal gland – associated with kidneys.
4. Pancreas – associated with liver.

Various endocrine glands, their location, hormones, functions and disorders of hypo and hypersecretion are given below in the table :

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	Gland and location	Hormones and their nature	Functions	Dis-orders
1.	Pituitary Gland (attached to the hypothalamus of brain)	Anterior Lobe (i) (FSH) Follicle-stimulating hormone (Protein)	Stimulates spermatogenesis in male, growth of ovarian follicle in female, induces testosterone secretion in male.	
		(ii) Luteinising Hormone(LH) (Protein)	Ovulation and secretion of estrogen and progesterone in female.	

2. How does the autonomic nervous system control heart rate?
3. What role does the parasympathetic system play after stress?
4. How can Vikram manage his anxiety?

Ans :

1. The sympathetic nervous system increases heart rate and prepares the body for action.
2. The autonomic nervous system controls involuntary functions like heart rate.
3. The parasympathetic system slows the heart rate and helps the body relax.
4. Vikram can manage anxiety through breathing exercises and relaxation techniques.

- 317.** Rina accidentally touches a hot pan and immediately pulls her hand away. Her doctor explains that this is an example of a reflex action, which is an automatic response to protect the body from harm.

1. What is a reflex action?
2. Why is Rina's reaction automatic?
3. What part of the nervous system controls reflexes?
4. Why are reflex actions important for safety?

Ans :

1. A reflex action is an involuntary response to a stimulus.
2. Rina's reaction is automatic because reflexes bypass the brain.
3. The spinal cord controls reflexes.
4. Reflex actions protect the body from immediate harm by responding quickly.

- 318.** Mohan has been experiencing difficulty hearing, particularly when there is background noise. His doctor identified a problem with the cochlea in his inner ear, which is not processing sound vibrations correctly.

1. What role does the cochlea play in hearing?
2. Why might Mohan have difficulty hearing in noisy environments?
3. What part of the ear processes sound vibrations?
4. How can inner ear issues affect hearing?

Ans :

1. The cochlea converts sound vibrations into nerve signals for the brain.
2. A damaged cochlea can make it hard to differentiate sounds in noisy environments.
3. The inner ear processes sound vibrations.
4. Inner ear issues can reduce the clarity and sharpness of hearing.

- 319.** Anita is learning to play the piano and realizes that after enough practice, her fingers move automatically across the keys. Her teacher explained that this is a result of her brain coordinating voluntary muscle movements over time, turning them into near-automatic responses.

1. What is the difference between voluntary and involuntary movements?
2. How does the brain control voluntary muscle movements?
3. How do repeated actions become automatic?
4. Why are muscle movements important in learning new skills?

Ans :

1. Voluntary movements are controlled by will, while involuntary movements happen automatically.
2. The brain sends signals to muscles to control voluntary movements.
3. Repeated actions are stored in memory, making them automatic over time.
4. Muscle movements are crucial for learning motor skills like playing the piano.

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		Medulla (i) Adrenaline (Amine) (ii) Noradren-aline (Amine)	Whip up metabolism in emergency by increasing heart beat, blood pressure, respiratory rate, blood sugar level, etc. Controls carbohydrate metabolism.	
4.	Pancreases (below stomach)	(i) Insulin (Protein)	Release of sugar from liver.	Deficiency causes diabetes mellitus.
		(ii) Glucagon (Protein)	Controls nutrient absorption into blood.	
		(iii) Somatostatin (Protein)	Inhibitor of growth hormone. Insulin and glucagon.	

Important Differences :

(a)

	Nervous Control	Endocrine Control
1.	Works by the conduction of nerve impulses.	Works by the release of chemical messenger the hormones.
2.	Works very rapidly.	Works slowly.
3.	Nerve Impulse is conducted through nerve fibres.	Hormones travel through blood stream.
4.	Effects of nerve impulses are short lived.	It has prolonged effect.
5.	Information is directed to specific part.	Information spreads throughout the body by blood stream.
6.	It has no effect on growth.	Affects growth.
7.	Does not influence chemical changes and cannot regulate metabolism.	It brings about specific chemical changes and regulate metabolism.

(b)

	Endocrine Gland		Exocrine Gland
1.	Ductless glands.	1.	Glands with ducts.

2.	Secrete hormones.	2.	Secrete enzymes or other useful substances.
3.	Their secretions always act away from the site of production.	3.	Their secretion may act away or at the site of their production.
4.	Secretions are transported by way of blood.	4.	Secretions are transported by way of ducts.

(c)

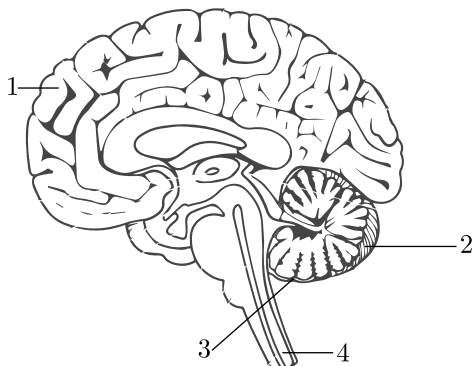
	Cretinism		Myxedema
1.	Caused by hyposecretion of thyroxine in infants.	1.	Caused by hyposecretion of thyroxine in adults.
2.	It is characterised by stunted growth, pot belly, protruding tongue and pigeon chest.	2.	It is characterised by puffy appearance due to accumulation of fat in the subcutaneous tissue and oedema.
3.	Mental and sexual retardation take place.	3.	Mental and sexual development is not affected but patients lack alertness.

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		(iii) Somatotropin (Protein)	Regulates protein metabolism and growth of bones.	Deficiency causes dwarfism, excess produces gigantism in young and acromegaly in adults.
		(iv) Prolactin (Protein)	Controls development of milk glands.	
		(v) Adreno-corticotropin (ACTH) (Peptide).	Stimulates secretion of hormones of adrenal cortex.	
		(vi) Thyotropin (TSH) (Protein)	Stimulates secretion of thyroid hormones.	
		Middle lobe (i) Melanocyte Stimulating Hormone (MSH) (Peptide)	Controls skin colour.	
		Posterior lobe (i) Oxytocin (Peptide)	Regulates uterine contractions and release of milk.	
		(ii) Vaso-pressin (Peptide)	Reduces loss of water in urine.	
2.	Thyroid (in the neck on the sides of trachea just below the larynx)	(i) Thyroxine (Iodinated amino acid)	Regulates oxidation of food, controls basal metabolic rate, differentiation and metamorphosis.	Deficiency causes diabetes insipidus. Hyposecretion causes cretinism in children Myxedema in adults.
		(ii) Calcitonin (Peptide)	Controls calcium and phosphorus balance in the blood plasma.	Iodine deficiency causes simple goitre. Hypers-ecretion causes. Grave's disease or exophthal-mic goitre.
3.	Adrenal (attached with the kidneys)	Cortex (i) Gluco-corticoids, e.g. Cortisol and cortico-sterone (stedoid)	Regulates carbohydrate, fat and protein metabolism.	Its deficiency causes Addison's diseases, excess causes Cushing's syndrome, Aldoster-onism.
		(ii) Mineralo-corticoids, e.g. Aldosterone (steroid)	Controls salt and water metabolism.	
		(iii) Sex corticoids (steroids) e.g. Adrenal androgen.	Produce accessory sex characters.	Excess in early life causes early abnormal sexual maturity.

313. The diagram represents human brain as seen in a external view.

(i) Name the parts 1, 2, 3 and 4.



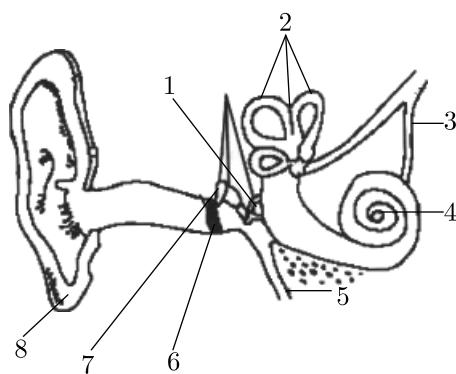
- (ii) Mention the difference in the arrangement of the nerve cells in parts marked 1 and 4.
 (iii) What is the main function of parts marked 3 and 4 ?
 (iv) Name the sheet of nerve fibres that connects the two halves of the part labelled 1.

Ans :

SQP 2018

- (i) 1. Cerebrum
 2. Cerebellum
 3. Medulla oblongata
 4. Spinal cord
 (ii) 1 – Cytons outside and axons inside
 2 – Axons outside and cytons inside
 (iii) 1 – Controls involuntary reflexes like respiration and circulation.
 2 – Mediates reflex actions
 (iv) Corpus callosum.

314. The diagram given below represents the parts of the human ear :



- (i) Name the parts labelled 1 to 8.
 (ii) What is the function of the parts marked 2 and 7?
 (iii) Why is it harmful to use a pin or any sharp object to remove the wax from the ear ?

Ans :

MAIN 1996

- (i) 1. Stapes, 2. Semi-circular canals, 3. Auditory nerve, 4. Cochlea, 5. Eustachian tube, 6. Ear-drum or Tympanum 7. Malleus, 8. Pinna.
 (ii) Function of Part 2 - It brings about the dynamic equilibrium which helps in the maintenance of body position in response to movement.
 Function of Part 7 - The hammer or Malleus is fastened to the ear-drum whose vibrations are transmitted through these three bones (malleus, incus and stapes) to the membrane across the oval window. These small bones act as levers and also serve to increase the magnitude or power of vibrations.
 (iii) The pin or any sharp object may injure the eardrum. So it is harmful and should be avoided altogether while removing the wax from the ear.

CASE BASED QUESTION

315. Aditi, a 14-year-old, struggles with blurry vision when looking at distant objects. Her doctor explained that her eye's lens is too curved, which leads to the image forming in front of the retina, a condition known as myopia.

- What causes blurry vision in myopia?
- How does the lens of the eye contribute to focusing light?
- What is the function of the retina in vision?
- How can myopia be corrected?

Ans :

- Myopia occurs when the lens is too curved, causing the image to form in front of the retina.
- The lens focuses light onto the retina to create a clear image.
- The retina converts light into nerve signals for the brain to process.
- Myopia is corrected with concave lenses, which help focus light on the retina.

316. Vikram feels anxious during exams, causing his heart to race. His doctor mentioned that his sympathetic nervous system is responsible for this 'fight or flight' response, which increases his heart rate.

- What does the sympathetic nervous system do in stressful situations?

(d)

	Gigantism		Acromegaly
1.	Caused by oversecretion of somatotropin from childhood.	1.	Caused by oversecretion of somatotropin after adolescence.
2.	Due to abnormal elongation of bones and muscles person is of abnormally large height.	2.	Abnormal increase of long bones of hand and legs; person has gorilla like appearance but is not a giant.

MULTIPLE CHOICE QUESTION

1. Priya tried to match the hormones with their effect on the human body. She tabulated the pairs as follows:

Hormone	Effect on the body
P	Stimulates conversion of Glycogen to Glucose
Q	Reabsorption of water by the Nephrons.

Identify the correct pair of hormones.

- (a) P — Insulin, Q — Glucagon.
 (b) P — Adrenaline, Q — Oxytocin.
 (c) P — Glucagon, Q — Vasopressin.
 (d) P — Vasopressin, Q — Adrenaline.

Ans :

SQP 2025

Thus (c) is correct option.

2. The hormone that affects urination is:
 (a) Adrenaline (b) Vasopressin
 (c) Oestrogen (d) Thyroxine

Ans :

MAIN 2024

Vasopressin, also known as antidiuretic hormone (ADH), plays a crucial role in regulating water balance and urine concentration in the body. Deficiency of ADH causes diabetes insipidus in which urination is frequent and copious. Thus (b) is correct option.

3. A gland which secretes both hormone and enzyme is the :
 (a) Pituitary (b) Pancreas
 (c) Thyroid (d) Adrenal

Ans :

MAIN 2013

A gland that both hormone and enzyme is the pancreas.

Thus (b) is correct option.

4. Gigantism and Acromegaly are due to :
 (a) Hyposecretion of Thyroxine.
 (b) Hyposecretion of Growth hormone
 (c) Hypersecretion of Thyroxine
 (d) Hypersecretion of Growth hormone

Ans :

SEM I, 2021

Growth hormones are secreted by the anterior lobe of the pituitary gland under the influence of GH- releasing hormone. Hypersecretion of growth hormones causes excessive growth. In children, overproduction causes gigantism while in adults it causes acromegaly. Growth hormone stimulates the growth of bones muscles and many internal organs and overproduction can lead to the abnormal growth of all such tissue.

Thus (d) is correct option.

5. Gigantism and Acromegaly are due to :
 (a) Hypersecretion of Growth hormone
 (b) Hypersecretion of Thyroxine
 (c) Hyposecretion of Growth hormone
 (d) Hyposecretion of Thyroxine

Ans :

SEM II, 2021

Growth hormones are secreted by the anterior lobe of the pituitary gland under the influence of GH- releasing hormone. Hypersecretion of growth hormones causes excessive growth. In children, overproduction causes gigantism while in adults it causes acromegaly. Growth hormone stimulates the growth of bones muscles and many internal organs and overproduction can lead to the abnormal growth of all such tissue.

Thus (c) is correct option.

6. Gigantism and acromegaly are due to
 (a) hyposecretion of thyroxine
 (b) hyposecretion of growth hormone
 (c) hypersecretion of thyroxine
 (d) hypersecretion of growth hormone

Ans :

COMP 2018

Acromegaly and gigantism are disorders of growth hormone hypersecretion. The most common cause is a growth hormone (GH) secreting adenoma in the pituitary gland.

Thus (d) is correct option.

7. Oxytocin is secreted by
 (a) Posterior lobe of pituitary
 (b) Hypothalamus
 (c) Anterior lobe of pituitary
 (d) Middle lobe of pituitary

Ans :

MAIN 2010

Oxytocin is secreted by paraventricular nuclei cells of the hypothalamus and transported through axons to the posterior lobe of the pituitary. Neurohypophysis (posterior pituitary) is a storage-releaser center for the hormone synthesis by the hypothalamus. Oxytocin acts on the smooth muscles of the body and stimulates their concentration i.e. during childbirth oxytocin causes contraction of uterine muscles. Oxytocin also helps in milk ejection from the ducts in the breast to the nipples.

Thus (a) is correct option.

8. Antidiuretic hormone ADH is produced from
 (a) Kidney
 (b) Hypothalamus
 (c) Posterior pituitary
 (d) Anterior pituitary

Ans :

SQP 2011

Antidiuretic hormone (ADH) is synthesized by hypothalamic neurons and stored in the posterior pituitary in form of Herring bodies. ADH has also called vasopressin or arginine vasopressin and it acts on renal tubules of nephrons in the kidney resulting in conditional reabsorption of water. The posterior pituitary (neurohypophysis) produces antidiuretic hormone when we intake less fluid so as to maintain osmotic concentration in blood. The posterior pituitary is also called Pars nervosa.

Thus (c) is correct option.

9. A gland having endocrine as well as exocrine function is
 (a) Pituitary
 (b) Thyroid
 (c) Adrenal
 (d) Pancreas

Ans :

MAIN 2004

The pancreas has both an endocrine and an exocrine function. The exocrine pancreas assists in food digestion by releasing a secretion rich in bicarbonate, which helps to neutralize the acidic environment created in the stomach.

Thus (d) is correct option.

10. Diabetes insipidus is due to failure of secretion of
 (a) Insulin
 (b) Aldosterone
 (c) ADH
 (d) Thyroid

Ans :

SQP 2019

Diabetes insipidus is due to the hyposecretion or failure of secretion of antidiuretic hormone (ADH) secreted by the posterior pituitary.

Thus (c) is correct option.

11. The deficiency of ADH causes :
 (a) Diabetes insipidus
 (b) Diabetes mellitus
 (c) Dwarfism
 (d) Acromegaly

Ans :

COMP 2020

Diabetes insipidus is caused by a lack of antidiuretic hormone (ADH), also called vasopressin, which prevents dehydration, or the kidney's inability to respond to ADH. ADH enables the kidneys to retain water in the body. The hormone is produced in a region of the brain called the hypothalamus.

Thus (a) is correct option.

12. Which of the following is secreted by the pituitary?
 (a) TSH releasing hormone
 (b) ACTH releasing hormone
 (c) Thyroxin
 (d) TSH

Ans :

SQP 2015

The pituitary gland is a bilobed gland situated just below the hypothalamus in the brain. This gland secretes growth hormone, thyroid stimulating hormone, adrenocorticotrophic hormone, luteinizing hormone, gonadotropic hormone, prolactin.

Thus (d) is correct option.

13. Gigantism and dwarfism are the diseases related to
 (a) Prolactin hormone of mammary gland
 (b) Growth hormone of adenohypophysis
 (c) Luteinising hormone of pituitary gland
 (d) Thyroid stimulating hormone of thyroid gland

Ans :

MAIN 2011

Gigantism and dwarfism are caused by abnormalities in the secretion of the growth hormone (somatotropin), which is produced by the adenohypophysis (anterior pituitary). Excessive secretion during childhood leads to gigantism,

while deficient secretion results in dwarfism. This hormone is critical for regulating the growth and development of bones and tissues.

Thus (b) is correct option.

- 14.** Cretinism and myxoedema are due to
- Hyposecretion of thyroxine
 - Hypersecretion of thyroxine
 - Hypersecretion of growth hormone
 - Hyposecretion of growth hormone

Ans :

SQP 2007

Cretinism (in children) and myxoedema (in adults) are caused by the hyposecretion of thyroxine, a hormone produced by the thyroid gland. Thyroxine plays a key role in regulating metabolism, growth, and development. Insufficient levels of thyroxine during childhood lead to cretinism, which results in stunted physical and mental growth. In adults, low thyroxine levels cause myxoedema, characterized by weight gain, fatigue, and swelling of the skin.

Thus (a) is correct option.

- 15.** Cretinism is due to
- Deficiency of thyroid in adults
 - Oversecretion of thyroid in children
 - Deficiency of thyroxine in children
 - Oversecretion of thyroid in adults

Ans :

SQP 2014

Cretinism and myxoedema are due to hyposecretion of thyroxine.

Thus (c) is correct option.

- 16.** Contraction of uterus during child birth is due to which hormone
- TSN
 - Glucagon
 - Oxytocin
 - FSH

Ans :

MAIN 2016

Oxytocin is a natural hormone that stimulates uterine contractions in childbirth and lactation after childbirth. It also affects aspects of human behavior and the male and female reproductive systems.

Thus (c) is correct option.

- 17.** Acromegaly is due to over secretion of
- GH in children
 - ACTH
 - GH after adolescence
 - Thyroid in adults

Ans :

MAIN 2023

Acromegaly is a disorder which occurs due to hypersecretion of growth hormone after the physical development of body is complete. There is abnormal thickening of bones and soft tissues. The frontal bone gets enlarged and thickened which gives a gorilla like appearance to the person. Growth hormone is secreted from the anterior lobe of pituitary gland which is part of adenohypophysis.

Thus (c) is correct option.

- 18.** Bulging of eyes, increased BMR, high B.P. and heart rate are symptoms of
- Cretinism
 - Myxedema
 - Exophthalmic goitre
 - Goitre

Ans :

COMP 2021

Bulging of eyes, increased BMR, B.P. and heart rate are symptoms of Exophthalmic goitre.

Thus (c) is correct option.

- 19.** Father of Endocrinology is
- Huxley
 - Thomas Addison
 - Abel
 - Kimball and Murlin

Ans :

SQP 2015

Thomas Addison is known as the father of endocrinology. He discovered Addison's disease was caused by a deficiency of aldosterone from the adrenal cortex.

Thus (b) is correct option.

- 20.** Cretinism, mental retardation, low intelligence quotient, abnormal skin, deaf-mutism, etc., are the results of
- Hyperthyroidism
 - Goitre
 - Hypothyroidism
 - Both (b) and (c)

Ans :

COMP 2021

Hypothyroidism or low secretion of thyroxine is associated with three conditions, namely, cretinism, simple goiter, and myxoedema. These conditions are further associated with mental retardation, low intelligence quotient, abnormal skin, deaf-mutism.

Thus (c) is correct option.

21. Which of the following glands is known as master gland?
- Adrenal glands
 - Kidneys
 - Pancreas
 - Pituitary

Ans :

MAIN 2000

The pituitary gland is sometimes called the "master" gland of the endocrine system because it controls the functions of many of the other endocrine glands. The pituitary gland is no larger than a pea, and is located at the base of the brain. Thus (d) is correct option.

22. Identify the correct statement.
- Hypothyroidism causes cretinism
 - Hypothyroidism causes goitre
 - Hyperthyroidism adversely affects the body physiology
 - All of the above

Ans :

SQP 2004

Hypothyroidism is a condition in which the thyroid gland produces or releases insufficient thyroid hormones or thyroxine. Hypothyroidism occurs when the thyroid gland makes or releases inadequate thyroid hormones or thyroxine. Hypothyroidism is linked to simple goiter, cretinism, and myxoedema. These disorders have a negative impact on the body's physiology because they induce skin abnormalities, thyroid gland enlargement, and other symptoms. Thus (d) is correct option.

23. Which of the following is produced from adrenal cortex?
- Aldosterone
 - Thyroxine
 - Adrenalin
 - Insulin

Ans :

SQP 2002

The adrenal cortex produces several hormones. The most important are aldosterone (a mineralocorticoid), cortisol (a glucocorticoid), and androgens and estrogen (sex hormones). Aldosterone helps the kidneys control the amount of salt in the blood and tissues of the body. Thus (a) is correct option.

24. A patient with weight gain and high blood pressure is diagnosed with Cushing's disease, caused by the over-secretion of a hormone from the adrenal cortex. Cushing's disease is due to oversecretion of

- Adrenal cortex
- Pituitary
- Thyroid
- Adrenal medulla

Ans :

COMP 2009

Cushing's disease is caused by the oversecretion of cortisol from the adrenal cortex. This happens due to excessive ACTH secretion from the pituitary, leading to elevated cortisol levels. Symptoms include weight gain, high blood pressure, and fatigue.

Thus (a) is correct option.

25. A doctor explains to a patient with bulging eyes that this condition, called exophthalmic goitre, is caused by the overactivity of the thyroid gland. Exophthalmic goitre is caused due to the overactivity of
- Thyroid
 - Thymus
 - Parathyroid
 - Adrenal cortex

Ans :

COMP 2016

Exophthalmic goitre, also known as Graves disease, is an autoimmune disease. It is a disease related to the thyroid gland and it is caused due to hyperthyroidism. Thyroid glands generally become enlarged and secrete high levels of thyroid hormones.

Thus (a) is correct option.

26. A patient visits a doctor with symptoms of abnormal bone growth. The doctor explains that such conditions, like gigantism in children and acromegaly in adults, occur due to the excessive release of a hormone that regulates body growth. Gigantism and Acromegaly are due to:
- Hyposecretion of Thyroxine
 - Hypersecretion of Thyroxine
 - Hyposecretion of Growth hormone
 - Hypersecretion of Growth hormone

Ans :

COMP 2005

Gigantism (in children) and Acromegaly (in adults) are caused by the hypersecretion of growth hormone. In children, excess growth hormone leads to gigantism, resulting in abnormal height and size. In adults, the same condition results in acromegaly, characterized by the enlargement of bones, particularly in the hands, feet, and face, as growth plates have already closed. Both conditions are linked to the overactivity of the

growth hormone, typically from the anterior pituitary gland.

Thus (c) is correct option.

- 27.** A doctor explains to a patient with diabetes that a specific type of cell in the pancreas is responsible for producing insulin, which helps regulate blood sugar levels. Insulin is secreted by
- Beta cells of pancreas
 - Alpha cells of pancreas
 - Delta cells of pancreas
 - None of the above

Ans :

COMP 2016

Insulin is a hormone that plays a crucial role in regulating blood sugar levels. It is secreted by the beta cells of the pancreas, specifically within the Islets of Langerhans. When blood glucose levels rise, such as after eating, beta cells release insulin, which allows cells to absorb glucose from the bloodstream and use it for energy. This helps maintain normal blood sugar levels and prevents conditions like hyperglycemia.

Thus (a) is correct option.

- 28.** A biology student is learning about glands in the human body and discovers that one particular gland is unique because it produces both hormones and enzymes, which play a crucial role in digestion and metabolism. A gland which secretes both hormone and enzyme is
- Pituitary
 - Pancreas
 - Thyroids
 - Adrenal

Ans :

SQP 2020

A gland that both hormone and enzyme is the pancreas.

Thus (b) is correct option.

- 29.** A patient with diabetes visits a doctor, who explains that a specific part of the body contains clusters of cells that regulate blood sugar levels by producing hormones like insulin. Islets of Langerhans are located in :
- Liver
 - Pituitary gland
 - Spleen
 - Pancreas

Ans :

SEM II, 2021

Islets of Langerhans are islands of endocrine cells scattered throughout the pancreas

Thus (d) is correct option.

- 30.** In a prenatal class, the instructor explains that a specific hormone triggers uterine contractions during childbirth. Contraction of uterus during child birth is due to which hormone

- Oxytocin
- Glucagon
- TSN
- FSH

Ans :

COMP 2017

Oxytocin is a natural hormone that stimulates uterine contractions in childbirth and lactation after childbirth. It also affects aspects of human behavior and the male and female reproductive systems.

Thus (a) is correct option.

- 31.** The child frightened by the loud noise, runs quickly to his mother. Which substance helps in this response?
- Insulin
 - Adrenaline
 - Amylase
 - Protease

Ans :

MAIN 2023

The child frightened by the loud noise runs quickly to his mother. Adrenaline substance helps in this response.

Thus (b) is correct option.

DIRECTION : Matching Type Question

- 32.** Suresh attempted to match hormones with their effects on the human body as shown below:

Hormone	Effect on the body
P	Lowers blood sugar levels
Q	Stimulates milk production in females

Identify the correct pair of hormones:

- P – Glucagon, Q – Prolactin.
- P – Insulin, Q – Prolactin.
- P – Insulin, Q – Oxytocin.
- P – Glucagon, Q – Oxytocin.

Ans :

MAIN 2010

Insulin lowers blood sugar levels, and prolactin stimulates milk production. Glucagon raises blood sugar levels, while oxytocin regulates uterine contractions and milk ejection but not production.

Thus (b) is correct option.

131. Maturation of graafian follicle

Ans :

SQP 2000

Follicle stimulating hormone

132. Descent of testes into scrotum

Ans :

MAIN 2004

Testosterone

133. Glucocorticoid secretion

Ans :

COMP 2017

Adrenocorticotrophic hormone

134. Sodium and potassium ion metabolism

Ans :

SQP 2019

Aldosterone.

DIRECTION : Complete the following table :

135. Complete the following table by filling in the blanks from 1 to 10 with appropriate terms :

S. No.	Gland	Secretion	Function/Effect on body
1.	Thyroid	<u>1</u>	<u>2</u>
2.	<u>3</u>	Vasopressin	<u>4</u>
3.	<u>5</u>	<u>6</u>	Promotes glucose utilization by the body cells.
4.	Lacrimal gland	<u>7</u>	<u>8</u>
5.	Adrenal medulla	<u>9</u>	<u>10</u>

Ans :

MAIN 2013

- Thyroxine
- Regulates oxidation of food/basal metabolic rate/promotes tissue metabolism, growth and differentiation.
- Posterior pituitary gland
- Increases re-absorption of water from kidneys (reduces loss of water in urine)/contraction of blood vessels causing rise in blood pressure.
- Adrenal cortex
- Glucocorticoids
- Tears
- Lubricates eye
- Adrenaline
- Prepares body from any emergency situation

136. Complete the following table by filling in blank space 1 to 8.

Name of Gland	Substance produced	One Important function
Beta cells	1. _____	2. _____
Islets of Langerhans	3. _____	
5. _____	Adrenaline	4. _____
7. _____	Thyroxine	6. _____
	LH	8. _____

Ans :

COMP 2004

- Insulin
- Regulates blood sugar level
- Adrenal gland
- Prepares the body for 'Flight' or 'fight' actions.
- Thyroid gland
- Promotes tissue metabolism, growth and differentiation.
- Anterior lobe of pituitary gland.
- Stimulates ovulation, maintenance of corpus luteum and secretion of progesterone in females and secretion of testosterone in males.

NODIA

DIRECTION : State the exact location :

137. Thyroid gland.

Ans :

SQP 2016

Below the larynx or ventro-lateral sides of larynx.

138. Pituitary gland.

Ans :

COMP 2011

Base of midbrain close to hypothalamus.

139. Islets of Langerhans

Ans :

MAIN 2017

In the pancreas.

DIRECTION : Differentiate between :

140. Difference between Vasopressin and Insulin (Deficiency disorder)

Ans :

MAIN 2015

Vasopressin – Diabetes insipidus

Insulin – Diabetes mellitus

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Lata said: Glucagon and oxytocin.

Abhay said: Somatostatin and insulin.

Who were correct?

- (a) Raj and Abhay.
- (b) Sonu and Lata.
- (c) Raj and Sonu.
- (d) Abhay and Lata.

Ans :

COMP 2000

Insulin, glucagon, and somatostatin are hormones secreted by the pancreas. Adrenaline is secreted by the adrenal gland, and oxytocin is secreted by the pituitary gland.

Thus (a) is the correct option.

- 39.** A teacher asked her students to name two organs involved in excretion in the human body.

Raj said: Kidneys and skin.

Sonu said: Lungs and heart.

Lata said: Skin and liver.

Abhay said: Kidneys and lungs.

Who were correct?

- (a) Raj and Abhay.
- (b) Sonu and Lata.
- (c) Lata and Sonu.
- (d) Raj and Lata.

Ans :

MAIN 2005

Kidneys and lungs are involved in excretion. Kidneys filter waste from the blood, and the lungs excrete carbon dioxide. Skin is involved in excretion of sweat, but the liver and heart are not excretory organs.

Thus (a) is the correct option.

- 40.** A teacher asked her students to list two functions of the liver.

Raj said: Detoxification and bile production.-
Sonu said: Blood sugar regulation and digestion of proteins.

Lata said: Production of bile and detoxification.-

Abhay said: Detoxification and urea production.

Who were correct?

- (a) Raj and Lata.
- (b) Sonu and Abhay.
- (c) Raj and Abhay.
- (d) Sonu and Lata.

Ans :

COMP 2016

The liver detoxifies harmful substances and produces bile. It helps regulate blood sugar, but it does not directly digest proteins or produce urea (which is produced by the kidneys).

Thus (c) is the correct option.

- 41.** A teacher asked her students to name two examples of vestigial organs in the human body.

- Raj said: Wisdom teeth and tailbone.- Sonu said: Ear muscles and appendix.- Lata said: Tailbone and appendix.- Abhay said: Wisdom teeth and nails.

Who were correct?

- (a) Raj and Lata.
- (b) Sonu and Lata.
- (c) Raj and Sonu.
- (d) Abhay and Raj.

Ans :

SQP 2019

Wisdom teeth, tail-bone, and appendix are vestigial organs. Ear muscles are vestigial, but nails are not vestigial; they serve an active function.

Thus (a) is the correct option.

ONE MARK QUESTIONS

DIRECTION : Give the category and select the odd one out.

- 42.** Goitre, dwarfism, acromegaly, cataract.

Ans :

MAIN 2006

Hormonal diseases – Cataract

- 43.** ADH, TSH, NADP, ACTH

Ans :

COMP 2006

Hormones – NADP

- 44.** Steroids, cortisone, testosterone, adrenaline, prolactin.

Ans :

SQP 2004

Hormones – Steroids

- 45.** Adrenal, liver, thyroid, pituitary

Ans :

MAIN 2003

Endocrine glands – Liver

- 46.** Adrenaline, penicillin, insulin, thyroxine

Ans :

SQP 2002

Hormones – Penicillin

- 47.** Vasopressin, Growth hormone, TSH, ACTH, FSH.

90. The hormone which stimulates the breakdown of glycogen in liver to glucose.

Ans : COMP 2016
Glucagon

DIRECTION : State true or false. Write correct statement by changing first word only.

91. Testosterone is an androgen.

Ans : MAIN 2006
True

92. The pituitary gland is both exocrine and endocrine in function.

Ans : COMP 2009
False Pancreas is both exocrine and endocrine in function.

93. Incorporation of iodine into table salt may reduce the incidence of simple goitre.

Ans : SQP 2014
True

94. The failure of estrogens result in eunuchoidism.

Ans : MAIN 2020
False

95. Vasopressin is related with the concentration of urine.

Ans : SQP 2005
True

96. A hormone responsible for puberty in male is testosterone.

Ans : SQP 2001
True

97. Prolactin stimulates milk secretion and growth of breast.

Ans : COMP 2004
True

98. Thyroid gland secretes adrenaline.

Ans : SQP 2015
False

99. Hormones are chemically proteins.

Ans : MAIN 2019
False

100. Acromegaly is caused due to an increase in the concentration of growth hormone.

Ans : COMP 2021
True

101. Myxedema is caused due to malfunctioning of thyroid gland.

Ans : SQP 2002
True

102. Hormones are produced by endocrine gland.

Ans : MAIN 2009
True

103. Insulin is produced by alpha cells of pancreas.

Ans : COMP 2012
False

104. Thyroid gland secretes adrenaline.

Ans : SQP 2021
False

105. Adrenal gland is called master gland.

Ans : MAIN 2010
False

106. Deficiency of iodine causes simple goitre.

Ans : MAIN 2018
True

107. Oxytocin is water retaining hormone.

Ans : SQP 2013
False

108. Hormones are chemically protein.

Ans : COMP 2004
True

109. Glucagon converts glucose into glycogen.

Ans : SQP 2000
False

110. Adrenal medulla produces adrenaline.

- Insulin
- 69.** A mixed gland
Ans : MAIN 2017
 Pancreas
- 70.** A hormone that controls basal metabolic rate.
Ans : SQP 2020
 Thyroxine
- 71.** The gland that regulates calcium in blood.
Ans : COMP 2023
 Parathyroid
- 72.** The chemical messengers.
Ans : MAIN 2021
 Hormones or Adrenalin.
- 73.** The master gland.
Ans : SQP 2019
 Pituitary gland
- 74.** A condition caused due to the hyposecretion of thyroxine in children.
Ans : COMP 2018
 Cretinism
- 75.** The hormone which prepares the body for defense.
Ans : MAIN 2016
 Emergency hormone/Adrenaline
- 76.** The endocrine cells present in pancreas.
Ans : COMP 2011
 Islets of Langerhans- α -cells, β -cells and δ -cells.
- 77.** A hormone secreted by thyroid gland.
Ans : SQP 2009
 Thyroxine
- 78.** A hormone secreted by adrenal gland.
Ans : MAIN 2006
 Adrenaline
- 79.** A condition caused due to the oversecretion of thyroxine.
Ans : SQP 2004
 Exophthalmic goitre
- 80.** The disease caused due to the deficiency of iodine.
Ans : COMP 2002
 Simple goitre
- 81.** The hormone which controls the water exchange in the renal tubules.
Ans : MAIN 2000
 ADH (Anti-diuretic Hormone)
- 82.** The hormone that controls the basal metabolic rate.
Ans : SQP 2004
 Thyroxine
- 83.** The condition which results in abnormally long bones, long lower jaw bone due to the hyposecretion of a pituitary hormone.
Ans : MAIN 2010
 Acromegaly
- 84.** The hormone associated with the metabolism of carbohydrates, proteins, calcium and phosphorus.
Ans : COMP 2007
 Thyroxine
- 85.** The hormone that controls the calcium content in blood plasma and its metabolism.
Ans : SQP 2017
 Calcitonin
- 86.** The hormone which regulates carbohydrate metabolism.
Ans : MAIN 2009
 Insulin
- 87.** The hormone which promotes re-absorption of water from nephrons.
Ans : COMP 2005
 ADH
- 88.** The hormone which increases blood glucose level.
Ans : SQP 2010
 Glucagon
- 89.** The Father of Endocrinology.
Ans : MAIN 2013
 Thomas Addison

33. Meera tried to match hormones with their effects on the body as shown below:

Hormone	Effect on the body
P	Increases heart rate
Q	Promotes growth of ovarian follicles

Identify the correct pair of hormones:

- (a) P – Adrenaline, Q – FSH.
 (b) P – Insulin, Q – FSH.
 (c) P – Adrenaline, Q – Prolactin.
 (d) P – Thyroxine, Q – LH.

Ans :

COMP 2020

Adrenaline increases heart rate, and FSH (Follicle Stimulating Hormone) promotes the growth of ovarian follicles. Insulin regulates blood sugar, and prolactin stimulates milk production. Thus (a) is correct option.

34. Rahul tried to match hormones with their effects on the body as shown below:

Hormone	Effect on the body
P	Promotes water retention in kidneys
Q	Raises blood calcium levels

Identify the correct pair of hormones:

- (a) P – Aldosterone, Q – Calcitonin.
 (b) P – Vasopressin, Q – Parathyroid hormone.
 (c) P – Vasopressin, Q – Calcitonin.
 (d) P – Adrenaline, Q – Parathyroid hormone.

Ans :

SQP 2011

Vasopressin promotes water retention in the kidneys, and the parathyroid hormone raises blood calcium levels. Calcitonin lowers calcium levels, while adrenaline affects heart rate and blood pressure.

Thus (b) is correct option.

35. Priya attempted to match hormones with their effects on the body as shown below:

Hormone	Effect on the body
P	Stimulates uterine contractions
Q	Promotes protein synthesis and growth

Identify the correct pair of hormones:

- (a) P – Oxytocin, Q – Somatotropin.
 (b) P – Insulin, Q – Somatotropin.
 (c) P – Vasopressin, Q – TSH.
 (d) P – Oxytocin, Q – LH.

Ans :

MAIN 2015

Oxytocin stimulates uterine contractions during childbirth, and somatotropin (growth hormone) promotes protein synthesis and overall growth. Insulin regulates blood sugar, and TSH stimulates the thyroid gland.

Thus (a) is correct option.

36. Alok tried to match hormones with their effects on the body as shown below:

Hormone	Effect on the body
P	Stimulates metabolism and oxygen consumption
Q	Decreases blood sugar levels

Identify the correct pair of hormones:

- (a) P – Thyroxine, Q – Insulin.
 (b) P – Adrenaline, Q – Glucagon.
 (c) P – Thyroxine, Q – Glucagon.
 (d) P – Adrenaline, Q – Insulin.

Ans :

COMP 2016

Thyroxine stimulates metabolism and increases oxygen consumption, while insulin decreases blood sugar levels. Glucagon raises blood sugar levels, and adrenaline increases heart rate and metabolism.

Thus (a) is correct option.

DIRECTION : Conversation Type Question

37. A teacher asked her students to give two examples of enzymes involved in digestion.

Raj said: Amylase and lipase.

Sonu said: Pepsin and insulin.

Lata said: Amylase and pepsin.

Abhay said: Lipase and bile.

Who were correct?

- (a) Raj and Lata.
 (b) Sonu and Lata.
 (c) Raj and Abhay.
 (d) Sonu and Abhay.

Ans :

SQP 2018

Amylase, lipase, and pepsin are enzymes involved in digestion, while insulin and bile are not enzymes. Insulin is a hormone, and bile is a digestive fluid. Thus (a) is the correct option.

38. A biology teacher asked her students to name two hormones secreted by the pancreas.

Raj said: Insulin and glucagon.

Sonu said: Insulin and adrenaline.

Ans : MAIN 2022
True

- 111.** Myxoedema is caused due to the malfunctioning of thyroid gland.

Ans : SQP 2020
True

- 112.** The pituitary gland is both exocrine and endocrine in function.

Ans : COMP 2018
False

- 113.** Enzymes are secreted directly into the organs.

Ans : MAIN 2017
True

- 114.** Hormones are secreted directly into the blood.

Ans : SQP 2012
True

DIRECTION : The statements given below are false. Rewrite the correct form of the statement by changing the word which is underlined :

- 115.** Alpha cells of pancreas secrete Insulin.

Ans : COMP 2011
Alpha cells of pancreas secrete Glucogen.

- 116.** Cretinism is caused due to deficiency of Adrenaline.

Ans : MAIN 2008
Cretinism is caused due to deficiency of Thyroxine.

DIRECTION : Name the hormone responsible for the following functions :

- 117.** Increase in heart beat

Ans : SQP 2009
Adrenaline

- 118.** Maintains glucose level in the blood

Ans : MAIN 2022
Insulin

- 119.** Converting glycogen to glucose

Ans : COMP 2017

Glucagon

- 120.** Regulates basal metabolism

Ans : SQP 2013
Thyroxine

- 121.** Ossification of bones

Ans : MAIN 2011
Thyroxine

- 122.** Prepares the body during emergency

Ans : COMP 2010
Adrenaline

- 123.** Responsible for normal growth of the whole body.

Ans : SQP 2008
Growth hormone

- 124.** Regulates the functioning of the male and female reproductive organs.

Ans : MAIN 2000
Gonadotropic (Somatotropin)

- 125.** Increased absorption of water in the kidneys.

Ans : SQP 2003
Vasopressin

- 126.** Increased blood supply to muscles.

Ans : COMP 2009
Adrenaline.

- 127.** Urinary elimination of water

Ans : MAIN 2010
Vasopressin

- 128.** Storage of glucose as glycogen

Ans : COMP 2014
Insulin

- 129.** Milk secretion

Ans : SQP 2008
Oxytocin

- 130.** Heart beat and blood pressure

Ans : COMP 2006
Thyroxine

154. Acromegaly**Ans :** SQP 2020

A condition caused by hypersecretion of growth hormone in adults. Its symptoms are extra growth of bones of the face, hands and feet.

DIRECTION : Answer the following questions:**155. Define the term exocrine gland with an example.****Ans :** COMP 2011

A gland which pours its secretion into a particular organ through duct.
For example, salivary gland, gastric gland, liver, etc.

156. What are hormones?**Ans :** SQP 2015

Hormones are the secretions of endocrine glands which are directly poured into the blood stream.

157. Name some endocrine glands.**Ans :** MAIN 2016

Pituitary, Thyroid, Adrenal, Pancreas, etc.

158. What are endocrine glands?**Ans :** COMP 2020

The glands which do not possess ducts are called ductless or endocrine glands. These glands seem to secrete hormones.

159. Briefly write about thyroid gland.**Ans :** MAIN 2018

Thyroid gland is a bilobed structure located in front of the neck just below the larynx. It produces two hormones, thyroxine and calcitonin. Thyroxine regulates the basal metabolism. Calcitonin controls the calcium level of blood.

160. Why are hormones called as 'chemical messengers'?**Ans :** SQP 2020

Hormones are chemicals which are directly poured into the blood stream and carried to all the parts of the body for the proper working of the body.

161. What are antagonistic hormones?**Ans :** COMP 2013

Antagonistic hormones are those that work against each other, e.g. insulin and glucagon

produced by the pancreas. Insulin decreases the blood sugar level while glucagon increases the blood sugar level.

162. What is Endocrinology ?**Ans :** SQP 2004

The science which deals with endocrine or ductless gland and their functions.

163. What is Cushings syndrome ?**Ans :** MAIN 2000

It is disorder caused by hypersecretion of adrenal cortex, resulting in excessive production of glucocorticoids.

164. Where are the tropic hormones produced and stored ?**Ans :** SQP 2011

In the anterior lobe of pituitary gland.

165. Match the items in column I with those in column II :

	Column I		Column II
1.	Cretinism	a.	shortage of glucose in blood
2.	Diabetes mellitus	b.	over secretion of growth hormone
3.	Insulin shock	c.	excess of glucose in blood
4.	Gigantism	d.	oversecretion of thyroxine
5.	Exophthalmic goitre	e.	dwarfism and mental retardation
6.	Acromegaly	f.	oversecretion of GH in adults
7.	Addison's disease	g.	oversecretion of insulin
8.	Tetany	h.	undersecretion of GH
9.	Dwarfism	i.	Decreased calcium in blood

Ans : MAIN 2009

1. → e; 2. → c;
 3. → g; 4. → b;
 5. → d; 6. → f;
 7. → a; 8. → i;
 9. → h.

141. (i) Diabetes mellitus and Diabetes insipidus
(ii) Acromegaly and Myxedema

Ans :

COMP 2004

(i)	Diabetes mellitus	Diabetes insipidus
	Caused by oversecretion of somatotropin from childhood.	Caused by oversecretion of somatotropin after adolescence.
(ii)	Acromegaly	Myxedema
	Due to oversecretion of growth hormone in adults.	Due to low secretion of thyroxine in adults.

142. Difference between Diabetes mellitus and Diabetes insipidus (reason/cause)

Ans :

MAIN 2012

Diabetes mellitus : Due to hyposecretion of insulin
Diabetes insipidus : Due to hyposecretion of ADH hormone

143. Insulin and Glucagon

Ans :

SQP 2012

	Insulin	Glucagon
(a)	It is secreted by β -cells of Islets of Langerhans of pancreas.	It is secreted by α -cells of Islets of Langerhans of pancreas.
(b)	It converts the excess of glucose into glycogen.	It converts glycogen into glucose.

DIRECTION : Choose the correct option :

144. (i) Which of the following gland has both endocrine and exocrine function (Pituitary, thyroid, pancreas, adrenal)
(ii) (Myxedema, simple goitre, exophthalmic goitre) is a disorder caused by excess thyroid hormone.
(iii) Insulin is secreted by (delta cells of pancreas, alpha cells of pancreas, Beta cells of pancreas, none of these).

Ans :

COMP 2000

- (i) Pancreas
(ii) Exophthalmic goitre
(iii) Beta cells of pancreas

145. Why people living in hilly regions usually suffer from simple goitre ?

Ans :

SQP 2011, 2005, 1996

Because the soil and water in hilly region is deficient in Iodine.

146. Name the endocrine gland that secretes Thyroxine. Give any one function of Thyroxine.

Ans :

SEM II, 2021

Thyroid gland. It regulates basal metabolism.

147. Give the full form of the abbreviation ACTH. Which gland secretes this hormone ?

Ans :

SEM II, 2021

Adreno cortico tropic hormone, Anterior pituitary gland secrete this.

148. Name the form in which glucose is stored in liver.

Ans :

COMP 2023

Glycogen

149. Expand the following biological abbreviations : TSH

Ans :

SQP 2019

Thyroid stimulating hormone

DIRECTION : Define the following :

150. Endocrine glands

Ans :

MAIN 2002

The glands without ducts are called endocrine glands. These produce hormones.

151. Hormones

Ans :

COMP 2008

The secretions of endocrine glands which are carried by blood to the target organs.

152. Exophthalmic goitre

Ans :

SQP 2004

The hypersecretion of thyroxine causes this disease. Its symptom is protrusion of eyeball.

153. Gigantism

Ans :

MAIN 2016

A condition caused by the hypersecretion of growth hormone by pituitary gland.

Ans : COMP 2010
Anterior lobe of pituitary – Vasopressin

- 48.** Cortisone, Somatotropin, Adrenocorticotrophic hormone, Vasopressin.

Ans : MAIN 2016
Cortisone, all others are secreted by the pituitary gland.

- 49.** ACTH, TSH, ADH, FSH

Ans : COMP 2017
ADH : Rest are hormones of anterior pituitary

- 50.** Thyroid, adrenal, pituitary, prostate

Ans : MAIN 2000
Prostate

- 51.** Cretinism, myxedema, goitre, scurvy.

Ans : SQP 2015
Scurvy

- 52.** Insulin, glucagons, diabetes insipidus, diabetes mellitus.

Ans : COMP 2001
Diabetes insipidus

- 53.** Addison's disease, Cushing's Syndrome, Acromegaly, Leukemia.

Ans : MAIN 2019
Leukemia Others are hormonal disorders

- 54.** Insulin, Adrenaline, Pepsin, Thyroxine.

Ans : SQP 2019
Pepsin Others are hormone

DIRECTION : Name the following :

- 55.** The pituitary hormone which stimulates contraction of uterus during child birth.

Ans : COMP 2017
Oxytocin

- 56.** The hormone secreted by beta cells of islets of langerhans.

Ans : MAIN 2001
Insulin

- 57.** An endocrine gland.

Ans : SQP 2001
Adrenal, thyroid /pituitary

- 58.** The endocrine gland which produces emergency hormone.

Ans : SQP 1998
Adrenal gland.

- 59.** The form in which glucose is stored in liver.

Ans : COMP 2015
Glycogen

- 60.** Hormones which stimulates other endocrine glands to produce their specific hormones.

Ans : MAIN 2014, 2012
Pituitary gland hormones

- 61.** The two portions of adrenal gland.

Ans : SQP 2017
Adrenal cortex and adrenal medulla

- 62.** The Master gland of the body.

Ans : MAIN 2023
Pituitary

- 63.** The cause of diabetes mellitus.

Ans : COMP 2014
Deficiency of insulin

- 64.** Two hormones secreted by neurohypophysis.

Ans : MAIN 2000
Oxytocin and vasopressin

- 65.** The structure which controls the master gland.

Ans : SQP 2007
Hypothalamus

- 66.** The disease caused by iodine deficiency.

Ans : SQP 2010
Goitre

- 67.** The hormone secreted by thyroid gland.

Ans : MAIN 2012
Thyroxine

- 68.** The hormone secreted by the beta cells of pancreas.

Ans : COMP 2015

- 166.** Make a table indicating the following glands (Pituitary, Thyroid, Pancreas and Adrenal), hormones produced by them, their main functions and diseases caused due to their hyposecretion and hypersecretion.

Ans :

MAIN 2003

Glands	Hormones	Functions	Diseases
1. Pituitary	Growth hormone Antidiuretic hormone	Growth of the body Re-absorption of water by kidney tubules	Gigantism (hyper-secretion) Dwarfism (hypo-secretion)
2. Thyroid	Thyroxine	Basal metabolic rate (BMR)	Diabetes insipidus Cretinism, exophthalmic goitre
3. Pancreas	Insulin	Glucose to glycogen	Diabetes mellitus
4. Adrenal	Glucocorticoids Mineralocorticoids	Control of carbohydrate and protein metabolism Control of mineral metabolism	Addison's disease (hypo-secretion) Cushing syndrome (hyper-secretion)

- 167.** Mention two differences in each case :

- Dwarfism and gigantism
- Cretinism and myxedema
- Diabetes insipidus and diabetes mellitus
- Insulin and glucagon

Ans :

COMP 2018

(i)	Dwarfism	Gigantism
	1. Caused due to deficiency of growth hormone. 2. Characterised by stunted growth and poor sexual development.	1. Caused due to oversecretion of growth hormone. 2. Characterised by growth of long bones resulting in abnormal height.
(ii)	Cretinism	Myxedema
	1. Caused due to malfunctioning of thyroid in children. 2. Results in retarded physical and mental development, short hand, feet and pigeon chest.	1. Caused due to malfunctioning of thyroid in adults. 2. Results in lower basal metabolism, swollen face, physical and mental dullness and impotency.

(iii)	Diabetes insipidus	Diabetes mellitus
	1. Caused due to under secretion of antidiuretic hormone. 2. Large quantity of water is lost along with urine but glucose is not excreted.	1. Caused due to under secretion of insulin hormone. 2. Glucose is excreted along with urine.
(iv)	Insulin	Glucagon
	1. Secreted by beta cells of islets of langerhans. 2. Converts glucose into glycogen and lowers the blood glucose level.	1. Secreted by the alpha cells of islets of Langerhans. 2. Converts glycogen into glucose and increases blood glucose level.

- 168.** Why do people living in hilly region usually suffer from simple goitre ?

Ans :

COMP 2002

Due to deficiency of iodine in their vegetation and water.

- 169.** What is virilism ?

Ans :

SQP 2017

The presence or development of secondary male characters in a woman.

- 170.** What are the symptoms of virilism ?

Ans :

MAIN 2015

Growth of beard, decrease in size of breast, low pitch voice, and lack of menstruation in females.

- 171.** What are tropic hormones ?

Ans :

COMP 2020

The hormones which stimulate other endocrine glands to release their hormones.

- 172.** In which sex is exophthalmic goitre more common?

Ans :

MAIN 2017

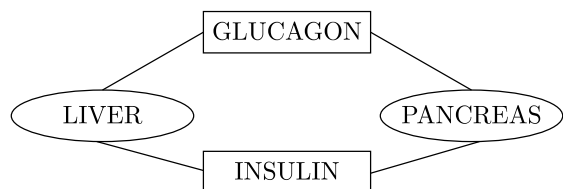
In females.

- 173.** Why is insulin injected into the body of a diabetic patient and not given orally ?

Ans :

COMP 2000

- 231.** Study the diagram given below and then answer the questions that follow :



- Name the cells of the pancreas that produce (1) glucagon (2) insulin.
- State the main function of (1) glucagon (2) insulin.
- Why is the pancreas referred to as an exo-endocrine gland ?
- Why is insulin not given orally but is injected into the body ?
- What is the technical term for the cells of the pancreas that produce endocrine hormones ?
- Where in the body is the pancreas located ?

Ans :

MAIN 2011

1. α - cell in islet of Langerhans.
2. β - cell in islet of Langerhans.
1. Converts glycogen to glucose.
2. Converts glucose to glycogen.
- Because it contains secretory structures i.e., acini (exocrine parts) which help in the digestion.
- Because it will be digested by the proteases enzymes in the stomach.
- Islet of Langerhans.
- Just below the stomach in the loop of duodenum of small intestine.

- 232.** The diagram given below represents the location and structure of an endocrine gland. Study the same and answer the questions that follow :



- Name the endocrine gland shown in the diagram.
- Name the secretion of the gland which regulates basal metabolism.

- Name the mineral element required for the synthesis of the above mentioned hormone.
- Name the disease caused due to undersecretion of the above mentioned hormone in children.
- Name the disease caused due to hypersecretion of the above mentioned hormone.

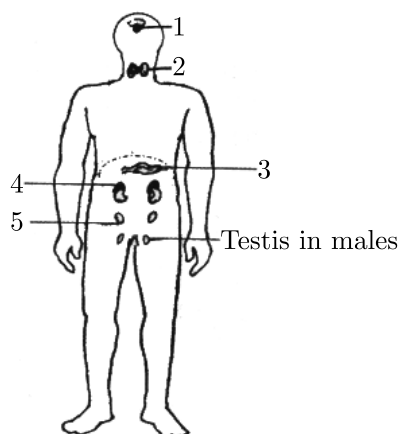
Ans :

COMP 2017

- Thyroid gland
- Thyroxine
- Iodine
- Cretinism
- Exophthalmic goitre/Grave's disease.

- 233.** The diagram shows some structures in ventral and dorsal view :

- Label the parts 1 to 5.
- What is common to all these parts in regard to the nature of their function ?
- In what way is part 3 different from other parts shown in the diagram ?
- Name the hormone secreted by testis.



Ans :

MAIN 2008

1. Pituitary gland
2. Thyroid gland
3. Pancreas
4. Adrenal glands
5. Ovary
- All are ductless glands which secrete hormones to act away from the site of their production.
- Part 3 pancreas is both endocrine and exocrine in function.
- Testosterone

- 234.** The diagram given below represents an endocrine gland in the human body. Study the diagram and answer the following questions :

- 194.** Complete the following table by filling in the blank spaces 1 to 8

Name of the Gland	Substance produced	One important function
Islets of Langerhans	1. _____	2. _____
3. _____	Adrenaline	4. _____
5. _____	Thyroxine	6. _____
7. _____	LH	8. _____

Ans :

COMP 2017

1. Insulin
2. Controls sugar level in the body
3. Adrenal
4. Increases heart beat
5. Thyroid
6. Controls basal metabolism of cells
7. Pituitary gland
8. Stimulates the production of progesterone/testosterone.

- 195.** Answer the following briefly :

- (i) If you stand to make your maiden speech before a large audience, your mouth dries up and heart beat increases. What brings about these changes?
- (ii) What are endocrine glands ?
- (iii) Explain briefly – ‘Glucose is normally not found in urine’.
- (iv) Why are hormonal reactions generally slower than nervous reactions.
- (v) A diabetic person has high concentration of sugar in urine-what is this condition known as ?

Ans :

SQP 2021

- (i) Adrenaline is secreted by Adrenal medulla which brings about these changes.
- (ii) The glands which pour their secretion directly into the blood are known as endocrine glands.
- (iii) Insulin converts excessive glucose in blood to glycogen which is stored in liver.
- (iv) Nervous reactions are co-ordinated by nerve impulses which travel very fast, whereas hormonal reactions are co-ordinated by hormones which travel through blood hence they are slow.
- (v) Glycosuria.

TWO MARKS QUESTIONS

- 196.** Expand the abbreviation — ADH. Give one example of a diuretic substance.

Ans :

SQP 2025

Antidiuretic Hormone
Alcohol, Coconut water, Caffeine, etc.

- 197.** Why is Adrenaline called 'The Emergency Hormone'?

Ans :

SQP 2025

It is secreted under conditions of stress like anger, fear, excitement. It prepares the body to face the emergency situation.

- 198.** What are Tropic hormones? Give one example

Ans :

SQP 2025

They stimulate other endocrine glands to secrete their specific hormones. E.g. TSH.

- 199.** Name the mineral elements required for

- (i) Clotting of blood
- (ii) Synthesis of thyroxine

Ans :

MAIN 2024

- (i) Calcium
- (ii) Iodine

- 200.** Define the term-Diapedesis.

Ans :

MAIN 2024

Diapedesis is the process by which white blood cells squeeze out through the walls of capillaries to reach at the site of infection.

- 201.** Define the term hormone.

Ans :

MAIN 2024

A hormone is a chemical messenger produced by glands or specialised cells, circulating in bodily fluids to regulate various physiological processes in the body.

- 202.** Give logic for why insulin is injected into the body of a highly diabetic patient and not given orally?

Ans :

MAIN 1996

Insulin is a protein, if it is given orally it will be digested in the intestine. Thus, it is injected directly into the blood.

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- 217.** Write three differences between hormones and enzymes.

Ans :

MAIN 2010

The differences between hormones and enzymes are as follows :

	Hormones	Enzymes
1.	Hormones are secreted by endocrine glands.	Enzymes are secreted by exocrine glands.
2.	Hormones generally act away from the site of secretion.	Enzymes act where these are secreted.
3.	Hormones may or may not be proteins.	Enzymes are always proteins.

- 218.** If one adrenal gland is removed the other one gets enlarged to some extent. Explain.

Ans :

MAIN 2016

The remaining adrenal gland has to double its works like-send more glucose and oxygen to the muscle to secrete the emergency hormone, etc. Therefore it gets enlarged.

- 219.** What is feedback mechanism ? Explain one example.

Ans :

SQP 2017

Feedback mechanism is one in which a tropic hormone stimulates a gland to secrete its hormone, which in turn inhibits the secretion of the hormone of anterior pituitary. For example TSH – RH stimulates thyroid gland to secrete thyroxine. But oversecretion of thyroxine inhibits the anterior pituitary to slow down the secretion of TSH – RH, so that a normal level of thyroxine is maintained in blood.

- 220.** Name the hormones produced by the following glands. In each case state one function of the hormone.
- Thyroid
 - Pancreas
 - Adrenal medulla

Ans :

MAIN 2000

- Thyroid :** Thyroxine and calcitonin - Thyroxine controls metabolic rates of carbohydrate, protein and fat.
- Pancreas :** Insulin and glucagon - insulin decreases blood glucose level.

- Adrenal medulla :** Adrenaline - Increases heart beat and blood pressure

- 221.** How do hormonal control differ from nervous control?

Ans :

SQP 2019

The differences between hormonal control and nervous control are as follows:

	Hormonal Control		Nervous Control
(a)	Slow.	(a)	Spontaneous.
(b)	Chemical signals are transmitted through blood.	(b)	Signals transmitted electrochemically through nerve fibres.
(c)	Its effects are long lasting.	(c)	Effects are short-lived.

- 222.** Insulin is injected into the body of a highly diabetic patient and is not given orally. Explain.

Ans :

MAIN 2012

Insulin is a protein hormone and if it is given orally it would be digested upon by the protein digesting enzymes in the alimentary tract.

- 223.** Name the part of human body in which the following glands are located:

- Thyroid
- Adrenal
- Pituitary

Ans :

COMP 2009

- Thyroid – Neck;
- Adrenal – Above Kidney;
- Pituitary – Brain

- 224.** Explain tropic hormone.

Ans :

SQP 2017

Tropic hormone is a hormone which targets other endocrine glands. It is secreted from the anterior lobe of pituitary gland. For example, TSH, which stimulates thyroid gland to secrete thyroxine.

- 225.** Complete the following table :

Gland	Secretions	Effect on Body
1	Oestrogen	2
Alpha cells of pancreas	3	4

organism and transported in tissue fluids such as blood or sap to stimulate specific cells or tissues into action.

- 214.** Match the items given in Column A with the most appropriate ones in Column B and rewrite the correct matching pairs.

	Column A		Column B
(i)	Cretinism	(a)	Hypersecretion of adrenal cortex
(ii)	Diabetes insipidus	(b)	Hyposecretion of thyroxine
(iii)	Exophthalmic goitre	(c)	Hyposecretion of growth hormone
(iv)	Adrenal virilism	(d)	Hyposecretion of vasopressin
(v)	Dwarfism	(e)	Hyposecretion of adrenal cortex
		(f)	Hypersecretion of growth hormone
		(g)	Hypersecretion of thyroxine

Ans :

SQP 2018

	Column A	Column B
(i)	Cretinism	Hyposecretion of thyroxine
(ii)	Diabetes insipidus	Hyposecretion of vasopressin
(iii)	Exophthalmic goitre	Hypersecretion of thyroxine
(iv)	Adrenal virilism	Hypersecretion of adrenal cortex
(v)	Dwarfism	Hyposecretion of growth hormone

- 215.** Give biological reasons : People living in hilly regions usually suffer from simple goitre.

Ans :

COMP 2011

Iodine is deficient in the soil of hilly regions, hence iodine is also deficient in the crops grown. So, people consume less iodine in their food. Iodine is needed for the production of thyroxine. Due to the deficiency of iodine, people suffer from simple goitre, i.e. swelling in the neck.

THREE MARKS QUESTIONS

- 216.** Given figure is the outline of the human body. Redraw the same and then place the following organs in the correct position and label them :
1-Thyroid gland; 2-Windpipe; 3-Diaphragm; 4-Right and left lungs; 5-Right and left kidneys; 6-Adrenal glands.

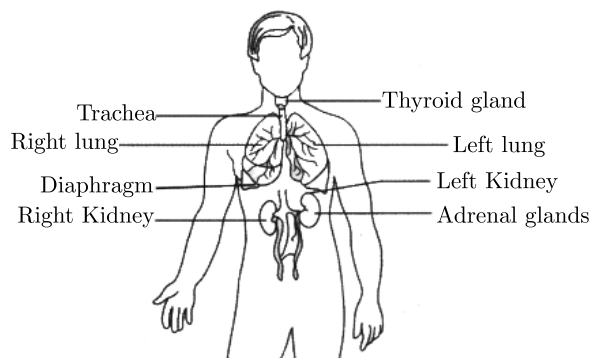


- Name the hormone produced by the thyroid gland and state its function in the body.
- What would a child suffer from if there was hyposecretion of this gland ?
- What role does the diaphragm play in the inspiration of air. Explain briefly.

Ans :

MAIN 1999

- Thyroxine - It controls cellular respiration/ controls carbohydrate metabolism.



- Cretinism.
- During inhalation, the diaphragm flattens and the volume of thoracic cavity increases and during exhalation diaphragm become dome-shaped thus decreasing the volume of thoracic cavity.

leading to weight gain and fatigue.

3. Common symptoms include fatigue, weight gain, and hair loss.
4. Hypothyroidism can be treated with hormone replacement therapy.

237. Amit, a 45-year-old man, was diagnosed with diabetes mellitus after experiencing excessive thirst, frequent urination, and fatigue. His doctor explained that his pancreas was not producing enough insulin, a hormone responsible for regulating blood sugar levels.

1. What is the role of insulin in the body?
2. How does a lack of insulin cause diabetes mellitus?
3. What are the symptoms of diabetes mellitus?
4. How is diabetes mellitus managed?

Ans :

1. Insulin helps regulate blood sugar by facilitating the uptake of glucose into cells.
2. A lack of insulin leads to high blood sugar levels, causing diabetes mellitus.
3. Symptoms include excessive thirst, frequent urination, and fatigue.
4. Diabetes is managed through insulin therapy, diet, and exercise.

238. Raj, a 25-year-old man, was involved in a minor car accident. During the incident, his heart raced, and he felt a surge of energy. His doctor explained that the adrenal glands had released adrenaline, a hormone that prepares the body for the 'fight or flight' response during stressful situations.

1. What is the function of adrenaline in the body?
2. How does adrenaline help the body respond to stress?
3. What are the physical effects of adrenaline release?
4. Which gland produces adrenaline, and where is it located?

Ans :

1. Adrenaline prepares the body for immediate physical action during stress.
2. It increases heart rate, blood pressure, and energy levels to help the body respond quickly.
3. Physical effects include increased heart rate, faster breathing, and heightened alertness.
4. Adrenaline is produced by the adrenal glands located above the kidneys.

239. Rekha, a 28-year-old woman, recently gave birth to her first child. During labor, her body released oxytocin, a hormone that regulates uterine contractions and facilitates childbirth. Her doctor explained that oxytocin also plays a role in breastfeeding by helping release milk from the mammary glands.

1. What is the role of oxytocin during childbirth?
2. How does oxytocin help with breastfeeding?
3. Which gland secretes oxytocin?
4. What are other functions of oxytocin in the body?

Ans :

1. Oxytocin stimulates uterine contractions, helping in the childbirth process.
2. It aids in the release of milk from the mammary glands during breastfeeding.
3. The posterior pituitary gland secretes oxytocin.
4. Oxytocin also helps in bonding and emotional regulation.

240. Sanjay, a 40-year-old man, has been experiencing weight gain, high blood pressure, and muscle weakness. His doctor diagnosed him with Cushing's syndrome, a condition caused by the overproduction of cortisol by the adrenal glands. This hormone, while important for managing stress, can cause significant health issues when produced in excess.

1. What is cortisol, and what is its primary function?
2. How does overproduction of cortisol lead to Cushing's syndrome?
3. What are common symptoms of Cushing's syndrome?
4. How is Cushing's syndrome treated?

Ans :

1. Cortisol helps regulate metabolism and manage stress responses.
2. Excess cortisol disrupts metabolism, leading to Cushing's syndrome.
3. Symptoms include weight gain, high blood pressure, and muscle weakness.
4. Treatment involves reducing cortisol levels, often through medication or surgery.

5	6	Protruding eyes
Lacrymal	7	8
9	10	Gigantism

Ans :

COMP 2004

- Ovary
- Responsible for developing characters of females.
- Secrete glucagon
- Glucagon helps to convert glycogen stored in liver to glucose
- Thyroid
- Thyroxine
- Tears
- Tears lubricate the eyes and prevent dust from entering in the eye.
- Pituitary gland.
- Growth hormone (somatotropin).

226. Explain briefly Glucose is normally not found in urine.

Ans :

COMP 2002

Excess glucose in the blood is converted into glycogen by insulin. Also it is reabsorbed in the proximal convoluted part of nephron.

227. Name antagonistic hormones. Write their actions.

Ans :

MAIN 2018

Insulin and glucagon are the antagonistic hormones. Insulin reduces the blood sugar level while glucagon increases the glucose level. Antagonistic means that both hormones showing opposite action against each other.

228. What is Virilism? What are the symptoms?

Ans :

SQP 2013

The presence or the development of male secondary characters in a women.

The symptoms are:

Growth of beard, lack of menstruation, decreased breast size.

229. Give the function of the following hormones:

- Thyroxine
- Insulin
- ADH

Ans :

SQP 2009

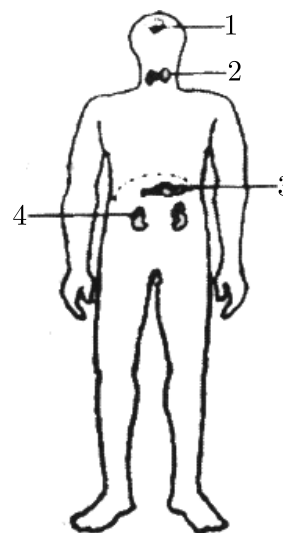
- Thyroxine – It controls the basal metabolism.
- Insulin – It decreases the blood sugar level.

- ADH – It controls the reabsorption of water in the kidney tubules.

FIVE MARKS QUESTIONS

230. Given below is the outline of the human body showing the important glands :

- Name the glands marked 1 to 4.
- Name the hormone secreted by part 2. Give one important function of this hormone.



- Name the endocrine part of the part numbered 3.
- Why is the part labelled 1 called the master gland? Which part of the fore-brain controls the gland labelled 1 ?
- Name the gland that secretes the 'emergency hormone'.

Ans :

SQP 2016

- 1-Pituitary gland, 2-Thyroid gland, 3-Pancreas, 4-Adrenal gland
- Thyroxine hormone, it controls basal metabolic rate.
- Islet of Langerhans.
- Pituitary gland is known as the master gland of the body because it controls other endocrine glands by the secretion of trophic hormones. Floor of diencephalon called hypothalamus controls the pituitary gland by the secretion of releasing and inhibiting factors/hormones.
- Emergency hormone is secreted by the adrenal medulla.

- 203.** Give appropriate biological or technical term for the following :
Hormones which regulate the secretion of other endocrine glands.

Ans : SQP 2018
Tropic hormone

- 204.** Simple goitre is usually seen in people living in the hilly regions. Give two reasons for the statement.

Ans : COMP 2021
Two reasons are :
(i) Deficiency of Iodine in the soil.
(ii) Iodine is an active ingredient in the production of thyroxine.

- 205.** What is Adrenal Virilism ? What causes this condition ?

Ans : SEM II, 2021
Development of male characters like beard, moustaches and deep male voice in female.
Cause : Over growth of adrenal cortex due to which excess secretion of male hormone androsterone takes place.

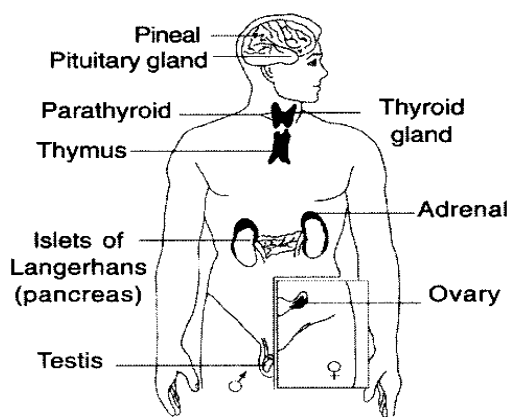
- 206.** Name the hormones whose deficiency causes :

- (i) Diabetes mellitus
- (ii) Diabetes insipidus

Ans : SEM II, 2021
(i) Insulin
(ii) Antidiuretic hormone or Vasopression.

- 207.** Make a very simple outline sketch of the human body and locate different endocrine glands and their position in it.

Ans : MAIN 1985



- 208.** Write briefly about :

- (i) Exophthalmic goitre (Symptoms and cause).
- (ii) Diabetes mellitus (symptoms and cause).

Ans : COMP 1995

- (i) **Symptoms :** Thyroid enlarged, eyes protrude out, high blood pressure and increase in body temperature, patient loses weight.

Cause : Excess of thyroxine secreted by thyroid gland.

- (ii) **Symptoms :** Increased thirst and urination, increased appetite, presence of glucose in urine.

Cause : Under secretion of insulin.

- 209.** Define :

- (i) Endocrine gland.
- (ii) Hormone

Ans : MAIN 2010, 1994

- (i) Endocrine glands are ductless glands which secrete hormones.
- (ii) Hormones are the secretions from specific cells or glands in the body and are carried to all parts of the body by the blood but their effect is produced in one or more specific parts only.

- 210.** What is the cause of developing facial hair in some women?

Ans : COMP 2023

The development of facial hair in some women is due to the overgrowth of adrenal cortex which produces cortisol.

- 211.** How is iodine important to our body?

Ans : SQP 2020

Iodine is needed for the synthesis of thyroxine. Its deficiency causes goitre.

- 212.** Give biological reasons for the following statements: Some women have facial hair like beard and moustache.

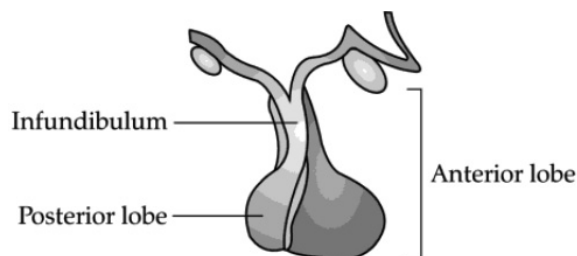
Ans : COMP 2017

Some women have facial hair like beard and moustache because of adrenal virilism, in which excess secretion of adrenal androgen takes place and causes this male effect in females.

- 213.** Briefly explain the term hormone.

Ans : SQP 2016

Hormone is a regulatory substance produced in an



- Identify the endocrine gland. Where is it located?
- Why is the above gland referred to as the 'Master gland'?
- Name the hormone which in deficiency causes Diabetes Insipidus. How does this disorder differ from Diabetes Mellitus?
- Explain the term 'Hormone'.
What is the role of Tropic hormones in the human body?
- Which lobe of the above gland secretes :
 - Oxytocin
 - ACTH
 - Growth hormone

Ans :

MAIN 2019

- Pituitary gland.
Location - Hangs from the base of midbrain below hypothalamus of brain.
- Because it controls practically all other endocrine gland.
- Antidiuretic hormone Its deficiency causes diabetes insipidus (hypoglycemia). Insufficient secretion of insulin causes diabetes mellitus (hyperglycemia). It passes sugar in urine.
- Hormone is the secretion from some glandular part of the body which is poured directly into blood and which acts on target organs or cells of same individual, bringing about coordination between distant parts of the body.
Tropic hormones stimulate other endocrine gland to produce their specific hormone.
- Posterior lobe
 - Anterior lobe
 - Anterior lobe

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- 235.** The sketch shows a certain condition in an individual.



- Name the condition.
- What is the underlying cause of this condition?
- Name two other conditions that could have resulted due to a similar cause.
- Which hormone is required for iodine synthesis?
- Where is thyroid gland located?

Ans :

COMP 2017

- Goitre
- Thyroid gland enlarges due to deficiency of iodine in the diet.
- Cretinism
 - Myxedema
- Thyroxine
- Thyroid gland occupies a mid ventral position in the posterior part of larynx in neck region.

CASE BASED QUESTION

- 236.** Nisha, a 30-year-old woman, has been feeling unusually fatigued, gaining weight, and experiencing hair loss. Her doctor diagnosed her with hypothyroidism, a condition where the thyroid gland does not produce enough thyroxine. This hormone is crucial for regulating metabolism, and its deficiency has slowed down her body's metabolic rate.

- What is the function of thyroxine in the body?
- How does hypothyroidism affect metabolism?
- What are common symptoms of hypothyroidism?
- How can hypothyroidism be treated?

Ans :

- Thyroxine regulates the body's metabolic rate and controls energy production.
- Hypothyroidism slows down metabolism,

Because insulin is a protein and if given orally will be digested by the digestive system and its effect will be reduced.

DIRECTION : Fill in the blanks :

- 174.** _____ Gland stimulates growth and stimulates secretion of hormones from other glands.

Ans : MAIN 2010
Pituitary

- 175.** _____ Hormone from thyroid regulates calcium and phosphate levels in the blood.

Ans : COMP 2015
Calcitonin

- 176.** _____ Stimulates contraction of uterus during labour.

Ans : SQP 2018
Oxytocin

- 177.** The two lobes of thyroid gland are joined by _____.

Ans : MAIN 2020
Gigantism

- 178.** The _____ glands produce hormones.

Ans : COMP 2023
Endocrine (ductless)

- 179.** The _____ is called as emergency hormone.

Ans : SQP 2016
Adrenaline

- 180.** Corpus luteum secretes _____ hormone.

Ans : COMP 2011
Progesterone

- 181.** Exophthalmic goitre is caused due to the hypersecretion of _____.

Ans : SQP 2020
Thyroxine

- 182.** The glands with ducts are called _____.

Ans : COMP 2014
Exocrine/ducted glands

- 183.** Adrenal medulla produces _____.

Ans : MAIN 2023
Adrenaline and noradrenaline

- 184.** _____ Secretes both hormones as well as enzymes.

Ans : SQP 2001
Pancreas

- 185.** Diabetes mellitus is caused due to the deficiency of _____.

Ans : COMP 2004
Insulin

- 186.** Diabetes insipidus is caused due to the deficiency of _____.

Ans : SQP 2009
ADH

- 187.** The alpha cells of pancreas produce _____.

Ans : MAIN 2022
Glucagon

- 188.** Adrenal gland : Kidney : : Pituitary gland : _____

Ans : COMP 2023
Brain

- 189.** _____ is the master gland.

Ans : MAIN 2006
Pituitary gland

- 190.** Insulin is produced by the _____ of Islets of Langerhans.

Ans : SQP 2007
 β -cells

- 191.** Emergency hormone is _____.

Ans : COMP 2016
Adrenaline

- 192.** Hypothyroidism causes _____.

Ans : SQP 2004
Simple goitre

- 193.** α -cells produce _____ hormone.

Ans : MAIN 2013
Glucagon

CHAPTER 11

THE REPRODUCTIVE SYSTEM

SUMMARY

1. REPRODUCTION

No organism survives forever and, therefore, if a species is to continue to exist, its members must reproduce their own kind. Hence, all the living organisms reproduce their own kind to maintain the continuity of their race. Reproduction, therefore, helps in the increase of population of the species. It transfers the characteristics of parents into the offspring. A new individual has to go through a period of growth and development before it reaches the stage at which it can reproduce itself.

1.1 Types of Reproduction

There are two types of reproduction which are as follows :

1. Asexual Reproduction :

In this type of reproduction a single organism is capable of producing its own kind. The participation of two organisms is not required and the individuals produced are genetically identical. It ensures rapid multiplication and it is mostly a characteristic feature of lower organisms.

2. Sexual Reproduction :

In this type of reproduction development of new individual takes place by fusion of two sex cells, the male and female gametes. Zygote formed by the fusion of male (sperm) and female (ovum) gametes gives rise to a multicellular embryo by repeated mitotic division. The embryo gradually develops into a full grown animal.

Sexual reproduction is energetically very expensive because large number of gametes must be generated of which only a few are used to form zygotes which grow to reproductive maturity. The advantage of sexual reproduction is the generation of variation upon which natural selection can act. In higher animals sperms and ova are produced in specialized sex organs said to be gonads. The

male gonad, called testis, produce sperms (male gamete) and the female gonad, known as ovary, produces ova (female gamete).

3. Sexual Dimorphism :

The phenomenon in which the male and female individuals of unisexual animals can be distinguished externally is called sexual dimorphism. Such externally visible characteristics which are restricted in a particular sex are called secondary sexual characters such as beard, moustaches, deep voice, narrow hips and chest in man, and bulky hips and developed breasts in woman.

2. REPRODUCTION IN HUMANS

Reproduction in humans are classifier in the following parts:

1. Primary reproductive parts - It includes gonads (testes in males and ovaries in females) which produce sex cells (gametes) - sperms and eggs or ova.
2. Accessory reproductive parts - Includes all those structures which help in transfer and meeting of the two kinds of sex cells leading fertilization and in the growth and development of the egg upto the birth of the baby.

3. THE MALE REPRODUCTIVE SYSTEM

It includes all body organs of man which helps in the production of male gametes and transference of semen or spermatid fluid in vagina of woman collectively constitutes the male reproductive system. It includes :

1. **A pair of testes :** They produce sperms. Each testis is enclosed in a capsule internally partitioned into many lobules and each lobule contains - Seminiferous tubule (where sperms are produced by spermatogenesis) and Interstitial or Leydig cells (which are packing tissues between the coils of seminiferous tubules. It produces the male hormone testosterone. Attached to the basement

10. The gland whose secretion neutralize the acidity of the urethra and vagina
- seminal vesicle
 - prostate gland
 - Cowper's gland
 - seminiferous tubules

Ans :

MAIN 2014

The Cowper's gland (also called bulbourethral gland) secretes a clear fluid that helps neutralize the acidity of the urethra in males and the vagina, ensuring that sperm can survive and move more easily during reproduction.

Thus (b) is correct option.

11. The structure in the male reproductive system that corresponds to oviduct of the female system is
- Vas deferens
 - epididymis
 - seminiferous tubule
 - urethra

Ans :

SQP 2010

The vas deferens in males corresponds to the oviduct (fallopian tube) in females. It transports sperm from the epididymis to the urethra during ejaculation, similar to how the oviduct carries the egg from the ovary to the uterus.

Thus (a) is correct option.

12. Which one of the following is the correct route that a sperm follows when it leaves the testis of a mammal?
- Epididymis → vas deferens → urethra
 - Vas deferens → epididymis → urethra
 - Urethra → epididymis → vas deferens
 - Epididymis → urethra → vas deferens

Ans :

MAIN 2010

After sperm is produced in the testis, it is stored and matures in the epididymis. From there, it moves through the vas deferens and then into the urethra, from where it is eventually expelled during ejaculation.

Thus (a) is correct option.

13. A vital connection between mother and foetus is called
- uterus
 - placenta
 - embryo sac
 - amniotic bag

Ans :

COMP 2002

The placenta is the vital connection between the mother and the fetus. It facilitates the exchange

of oxygen, nutrients, and waste products between the mother's blood and the fetus, ensuring proper development

Thus (b) is correct option.

14. Fertilization of an ova takes place in the
- fallopian tubes
 - uterus
 - vagina
 - ovary

Ans :

COMP 2017

Fertilization typically takes place in the fallopian tubes, where the sperm meets the egg after ovulation. The fertilized egg then moves to the uterus for implantation and further development.

Thus (a) is correct option.

15. Which of the following is not a part of the female reproductive system in human beings?
- Uterus
 - Ureter
 - Ovary
 - Fallopian tube

Ans :

MAIN 2013

The ureter is not part of the female reproductive system. It is a tube that connects the kidneys to the bladder, carrying urine. The reproductive system includes organs like the uterus, ovaries, and fallopian tubes, which are involved in reproduction.

Thus (b) is correct option.

16. The twins formed from a single ovum and fertilised by a single sperm are called
- fraternal twins
 - homologous twins
 - identical twins
 - none of the above

Ans :

SQP 2002

Identical twins are formed when a single ovum is fertilized by a single sperm and then splits into two embryos. These twins share the same genetic material and are of the same sex, making them identical in appearance.

Thus (c) is correct option.

17. Which of the following is not a part of the female reproductive system in humans?
- Ovary
 - Uterus
 - Fallopian tube
 - Vas deferens

Ans :

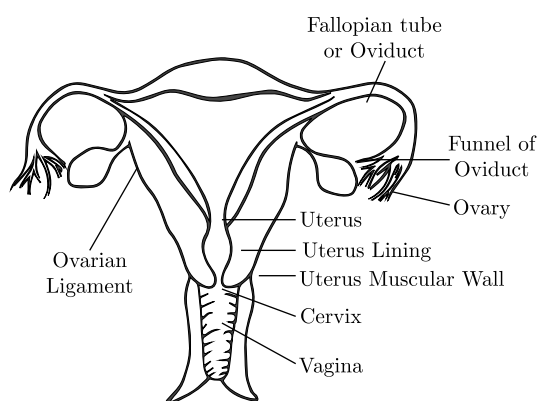
COMP 2004

The vas deferens is part of the male reproductive system, responsible for transporting sperm from the epididymis to the urethra. The ovary, uterus, and fallopian tube are part of the female reproductive system.

Thus (d) is correct option.

neck.

5. **Vagina** : It is a muscular passage that connects the uterus with the external world. Amazingly expandable it serves as receptacle for the male penis and sperms for copulation and a corridor for the emergence of the baby into the outside world. A thin mucous membrane called hymen covers the vaginal opening either partly or entirely. The hymen, however, eventually breaks, sometimes during sports or other physical activity or during the initial act of sexual intercourse.
6. **Vulva** : The external genital organs of females are collectively called as vulva. It has independent opening of vagina and urethra. The sides of vulva has labia minora (lesser lips) and labia majora (greater lips), which are equivalent to the male scrotum. In the uppermost angle of vulva in front of the urethral opening is located a small erectile clitoris which is highly sensitive and is equivalent of male penis. Accessory glands : The vagina remains moistened by Bartholins glands, which is located one on each side of the vaginal opening. They secrete mucus which helps in lubrication during copulation and parturition. A pair of well developed mammary glands are also present in females on the anterior lateral sides of the chest. Before puberty these are very small, rounded structures, but during the attainment of puberty they grow in size. These mammary glands secrete milk known as colostrums for the first time after the delivery of the first child.



5. PUBERTY

The onset of reproductive life is called puberty. It is the time when gonads develop both endocrine and gametogenic functions.

1. In males puberty starts at the age of 11 years. Following changes take place during puberty in males-
 - (a) Physical change - Testes enlarges, appearance of beard and moustaches, growth of auxiliary, pubic and chest hairs, pectoral girdle grows more than pelvic girdle.
 - (b) Sexual change - Spermatogenesis occurs and formation of semen takes place.
 - (c) Mental change - Attraction for girls.
2. In females, puberty starts at the age of 10 -14 years. Following changes take place during puberty in females-
 - (a) Physical change - Breasts develop and enlarge, auxiliary and pubic hair grows, broadening of hips take place, growth of long bones stop.
 - (b) Sexual change - Oogenesis takes place and ovums are formed, menstrual cycle and ovulation begins.
 - (c) Mental change - Sexual desire appears.

5.1 Fertilization

In human female fertilization takes place inside the fallopian tube i.e. it is internal. During sexual intercourse or coitus or copulation semen or spermatid fluid is released into the vagina of females by the penis of males. The sperms from vagina starts moving towards uterus and then to fallopian tube. If there happened to be an egg or ovum in the oviduct a large number of sperms surround the egg from all sides. But out of all these sperms only one will be able to enter into the egg and all others die. After entry of sperm into the ovum the sperm moves towards the haploid nucleus of egg and fertilizes the egg. As a result zygote is formed. Fertilization occurs usually within 24 hours of ovulation.

1. Implantation and Pregnancy

Attaching of developing embryo to the uterine wall of mother is called implantation. It produces the state of pregnancy. At the end of fourth day of fertilization the developing embryo reaches uterus and is a solid ball of cells called morula which later converts into a fluid filled embryo called blastocyst. The outer layer of blastocyst is nutritive in function and is called trophoblast. The trophoblast of blastocyst digests and reabsorbs the uterine endometrium producing a pit. In this pit the developing embryo settles and the endometrium grows over it. This is called implantation which is a must to get nourishment

Ans :

SQP 2020

The placenta is the structure that connects the fetus to the mother. It allows the exchange of nutrients, oxygen, and waste products, ensuring the proper development of the fetus throughout pregnancy.

Thus (d) is correct option.

26. Testes produce the hormone

- (a) testosterone (b) oxytocin
(c) progesterone (d) oestrogen

Ans :

COMP 2000

The testes produce the hormone testosterone, which is responsible for the development of male secondary sexual characteristics, such as increased muscle mass, facial hair, and a deeper voice, as well as sperm production.

Thus (a) is correct option.

27. Seminal plasma, the fluid part of semen is not contributed by

- (a) seminal vesicle
(b) prostate
(c) bulbourethral gland
(d) urethra

Ans :

SQP 2006

The urethra does not contribute to the production of seminal plasma; it merely serves as a passage for semen and urine. Seminal plasma is mainly produced by the seminal vesicles, prostate gland, and bulbourethral glands to nourish and protect sperm.

Thus (d) is correct option.

28. In female after how much time after fertilisation does the fertilised egg get implanted in the uterine wall ?

- (a) few months (b) one month
(c) about seven days (d) three weeks

Ans :

MAIN 2010

The fertilized egg, or zygote, typically implants in the uterine wall about seven days after fertilization. This process allows the embryo to start developing as it attaches to the nutrient-rich uterine lining.

Thus (c) is correct option.

29. The technical term for the fertilized egg is

- (a) placenta (b) morula
(c) zygote (d) embryo

Ans :

COMP 2015

The fertilized egg is technically called a zygote. It is the first stage of development after the sperm fertilizes the egg, and it eventually divides and develops into a morula, then an embryo.

Thus (c) is correct option.

30. The fraternal twins are

- (a) of same sex
(b) one boy and one girl
(c) either sex
(d) any of the above

Ans :

MAIN 2011

Fraternal twins can be of any sex combination because they are formed from two separate eggs, each fertilized by a different sperm. They can both be boys, both girls, or one boy and one girl. Therefore, fraternal twins can be of the same sex or different sexes.

Thus (d) is correct option.

31. Finger-like projections of the oviduct funnel are called

- (a) fimbriae (b) cilia
(c) cervix (d) clitoris

Ans :

SQP 2019

The fimbriae are the finger-like projections at the end of the oviduct (fallopian tube) that help guide the released egg from the ovary into the fallopian tube during ovulation. They play a key role in the process of fertilization.

Thus (a) is correct option.

32. The middle piece of sperm has

- (a) golgi body (b) ER
(c) ribosome (d) mitochondria

Ans :

MAIN 2021

The middle piece of sperm contains mitochondria, which generate the energy required for the movement of the sperm. This energy enables the sperm to swim toward the egg for fertilization.

Thus (d) is correct option.

33. Which of the following is a primary sex organ?

- (a) vas deferens
(b) seminal vesicles
(c) prostate
(d) testis

Ans :

COMP 2001

The testis is the primary sex organ in males, responsible for producing sperm and the hormone testosterone. The other structures, such as the

- (a) Assertion is True and Reason is False
- (b) Assertion is False and Reason is True
- (c) Both Assertion and Reason are True
- (d) Both Assertion and Reason are False

Ans :

SQP 2025

Thus (c) is correct option.

3. A zygote which has *Y* chromosome inherited from the father will develop into a:
- (a) Will depend on the chromosome inherited from the mother
 - (b) Girl
 - (c) Either boy or a girl
 - (d) Boy

Ans :

MAIN 2024

In humans, the presence of a *Y* chromosome in the zygote will develop into a male child. The sperm carries either an *X* or a *Y* chromosome, while the egg always carries an *X* chromosome. If the sperm carrying an *X* chromosome fertilises the egg, the resulting zygote will be *XX*, leading to the development of a female child. Conversely, if the sperm carrying a *Y* chromosome fertilises the egg, the zygote will be *XY*, resulting in the development of a male child.

Thus (d) is correct option.

4. A biology teacher explains that in human males, sperm cells determine the sex of the offspring because each sperm carries only one type of sex chromosome. In a human male, a sperm will contain :
- (a) Both *X* and *Y* chromosomes
 - (b) Only *Y* chromosome
 - (c) Only *X* chromosome
 - (d) Either *X* or *Y* chromosome

Ans :

MAIN 2019

In human males, sperm cells carry either an *X* or a *Y* chromosome, not both. This determines the sex of the offspring, as an *X* chromosome from the sperm will result in a female (*XX*), and a *Y* chromosome will result in a male (*XY*).

Thus (a) is correct option.

5. On which day of the menstrual cycle does ovulation take place ?
- (a) 5th day
 - (b) 28th day
 - (c) 14th day
 - (d) 1st day

Ans :

COMP 2019

In a standard 28-day menstrual cycle, ovulation generally happens around the 14th day, which is

approximately halfway through the cycle. This is the time when the ovary releases a mature egg, ready for fertilization.

Thus (c) is correct option.

6. The technical term for the fertilized egg is
- (a) placenta
 - (b) zygote
 - (c) morula
 - (d) embryo

Ans :

SQP 2010

The zygote is the technical term for the fertilized egg, formed when a sperm cell from the male fertilizes an egg cell from the female. It is the first cell of a new organism and undergoes multiple divisions to eventually form the embryo.

Thus (b) is correct option.

A single highly coiled tube where sperms are stored, gets concentrated and mature is

- (a) Epididymis
- (b) Vas efferentia
- (c) Vas deferens
- (d) Seminiferous tubule

Ans :

COMP 2015

The epididymis is a long, coiled tube where sperm is stored, concentrated, and allowed to mature after being produced in the seminiferous tubules. This maturation process is essential for the sperm to gain motility and fertilizing capability.

Thus (a) is correct option.

8. The surgical method of sterilization in women involves the cutting and tying of :
- (a) Ureter
 - (b) Oviduct
 - (c) Urethra
 - (d) Uterus

Ans :

SQP 2005

In women, the surgical sterilization procedure, known as tubal ligation, involves the cutting and tying of the oviducts (also called fallopian tubes). This prevents eggs from traveling from the ovaries to the uterus, effectively preventing fertilization and pregnancy.

Thus (b) is correct option.

9. Fertilization takes place in
- (a) uterus
 - (b) oviduct
 - (c) cervix
 - (d) ovary

Ans :

MAIN 2008

Fertilization typically occurs in the oviduct (also known as the fallopian tube). This is where the sperm meets and fertilizes the egg, forming a zygote. The fertilized egg then travels to the uterus for implantation.

Thus (b) is correct option.

41. A single highly coiled tube where sperms are stored, get concentrated and mature is known as
 (a) vas efferentia
 (d) epididymis
 (c) vas deferens
 (d) seminiferous tubule

Ans :

SQP 2022

The epididymis is a long, coiled tube located behind the testes. It plays a crucial role in storing, concentrating, and allowing the sperm to mature. Sperm gain motility and the ability to fertilize an egg during their time in the epididymis.

Thus (b) is correct option.

42. Fertilization takes place in
 (a) fimbriae (b) uterus
 (c) vagina (d) oviduct

Ans :

MAIN 2023

Fertilization, the fusion of a sperm and an egg, typically occurs in the oviduct (also known as the fallopian tube). After ovulation, the egg is released into the oviduct, where it meets the sperm, leading to fertilization. The fertilized egg then moves toward the uterus for implantation.

Thus (d) is correct option.

43. At which of the following stages the implantation in uterus takes place?
 (a) 8 cell stage (b) morula
 (c) blastocyst (d) late gastrula

Ans :

COMP 2014

Implantation occurs when the blastocyst, a hollow ball of cells formed after fertilization, attaches itself to the lining of the uterus. This stage occurs around 5-7 days after fertilization. The blastocyst consists of an outer layer of cells (trophoblast) that will help form the placenta and an inner cell mass that will develop into the embryo.

Thus (c) is correct option.

44. Vas deferens is a part of a
 (a) testis (b) epididymus
 (c) duct system (d) accessory glands

Ans :

MAIN 2008

The vas deferens is a tube that is part of the male reproductive duct system. It transports mature sperm from the epididymis to the urethra during ejaculation. The duct system also includes the epididymis and ejaculatory ducts, which work together to store, transport, and deliver sperm.

Thus (c) is correct option.

45. Fertilisation is the process of fusion of male gamete and the female gamete to produce a/an
 (a) embryo (b) zygote
 (c) infant (d) child

Ans :

SQP 2000

Fertilization results in the formation of a zygote, which is the first cell of a new organism. The zygote undergoes cell divisions and develops into an embryo, eventually leading to the formation of a fetus.

Thus (b) is correct option.

46. A single highly coiled tube where sperms are stored and get matured is known as
 (a) vasa efferentia
 (b) epididymus
 (c) vas deferens
 (d) seminiferous tubules

Ans :

MAIN 2007

The epididymis is a long, coiled tube located behind the testes. It is responsible for storing, concentrating, and allowing the sperm to mature, gaining motility and the ability to fertilize an egg.

Thus (b) is correct option.

47. The onset of menstruation in the female is
 (a) Menarche (b) Ovulation
 (c) Menopause (d) Parturition

Ans :

COMP 2019

Thus (c) is correct option.

48. The onset of menstruation in the female is
 (a) Ovulation (b) Menopause
 (c) Menarche (d) Parturition

Ans :

MAIN 2001

Thus (c) is correct option.

49. In the human menstrual cycle, the ovulation occurs around
 (a) day 10 (b) day 24
 (c) day 1 (d) day 14

Ans :

SQP 2006

Thus (d) is correct option.

50. The external female genitalia is known as
 (a) vagina (b) uterus
 (c) cervix (d) vulva

Ans :

MAIN 2011

Thus (d) is correct option.

- 18.** Given below is a statement or question followed by four choices. Select and rewrite the correct answer to the given statement.

The onset of menstruation in the female is termed as

- (a) ovulation (b) parthenogenesis
(c) menopause (d) menarche

Ans :

SQP 2018

Menarche refers to the first occurrence of menstruation, marking the beginning of a female's reproductive years. Menopause is when menstruation ceases, ovulation is the release of an egg, and parthenogenesis is a form of asexual reproduction.

Thus (d) is correct option.

- 19.** Gestation period of human is
(a) 250 days (b) 280 days
(c) 170 days (d) 140 days

Ans :

MAIN 2023

The gestation period of humans is approximately 280 days, which is around 9 months, the time it takes for a baby to fully develop from conception to birth.

Thus (b) is correct option.

- 20.** In a biology class, students learn that fertilization in humans occurs in a specific part of the female reproductive system. In humans, the fertilisation take place in :
(a) uterus (b) oviducal funnel
(c) vagina (d) fallopian tube

Ans :

COMP 2020

In humans, fertilization typically occurs in the fallopian tube. After ovulation, the egg travels into the fallopian tube, where it may meet the sperm and undergo fertilization before moving to the uterus for implantation.

Thus (d) is correct option.

- 21.** The period of intrauterine development of the embryo is known as
(a) embryonic development
(b) parturition
(c) gestation period
(d) implantation

Ans :

SQP 2014

The gestation period refers to the time of intrauterine development from fertilization until birth. It is the period during which the embryo and fetus grow inside the mother's uterus.

Parturition refers to the process of giving birth, and implantation is the attachment of the embryo to the uterine wall.

Thus (c) is correct option.

- 22.** In the human menstrual cycle, the ovulation occurs around
(a) day 14 (b) day 24
(c) day 10 (d) day 1

Ans :

MAIN 2001

Ovulation typically occurs around day 14 of a 28-day menstrual cycle. This is the time when a mature egg is released from the ovary, ready for potential fertilization.

Thus (a) is correct option.

- 23.** Which of the following is not true for the process of ovulation in human?
(a) The egg is released from Graafian follicle
(b) The fertilised egg passes out of female's body
(c) The egg is fertilised in Fallopian tube
(d) The egg passes through fimbriated funnel of Fallopian tube

Ans :

SQP 2016

During ovulation, the egg is released from the Graafian follicle in the ovary, passes through the fimbriated funnel of the fallopian tube, and can be fertilized in the fallopian tube. However, if the egg is fertilized, it does not pass out of the body but implants in the uterus for development.

Thus (b) is correct option.

- 24.** Sperms are produced in
(a) seminiferous tubules
(b) epididymus
(c) vasa efferentia
(d) leydig cells

Ans :

MAIN 2005

Sperms are produced in the seminiferous tubules of the testes. These tubules are responsible for the process of spermatogenesis, where sperm cells are developed. The epididymus stores and matures the sperm, while Leydig cells produce testosterone, but they do not produce sperm.

Thus (a) is correct option.

- 25.** The association between the foetus and mother is called
(a) embryonic membrane
(b) amnion
(c) chorion
(d) placenta

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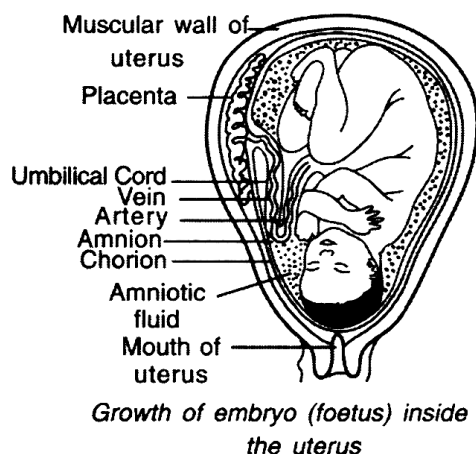
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and oxygen from the mother for rapid development.



2. Placenta

An intimate connection is established between the foetal membrane and the uterine wall by a structure known as placenta. The main task of placenta is to permit the diffusion of nourishment from mother's blood to the baby's and the disposal of waste products from the baby's blood to the mother's.

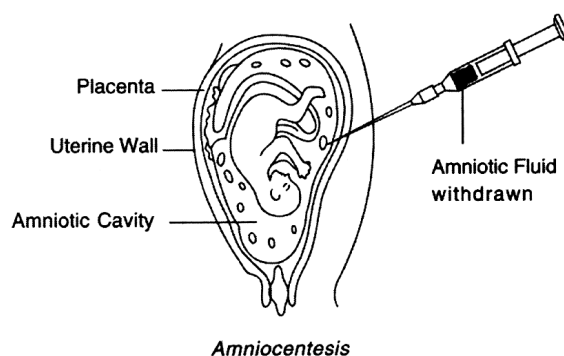
3. Parturition

It is the act of expelling the full term foetus from the mother's uterus at the end of gestation

(duration of embryonic development, in the uterus starting from implantation to the birth of the child). The length of time from conception to birth (gestation period) is about 280 days.

4. Amniocentesis

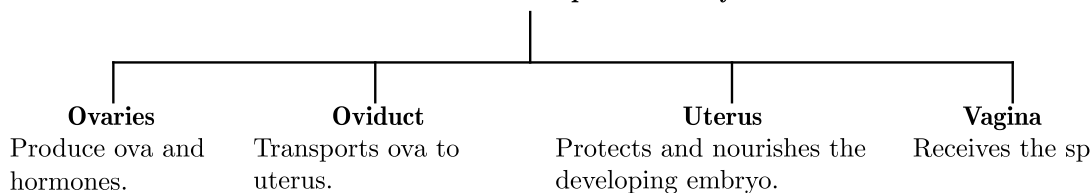
A technique to diagnose foetal abnormalities by drawing a sample of amniotic fluid by a needle inserted through mother's abdomen into the uterus. This fluid contains cells which can be studied for several defects and also to know the sex of a child.



Stages in the development of human embryo :

Egg (ovum) → zygote → morula → trophoblast → blastocyst → embryo (3 weeks) → advanced embryo (5 weeks) → foetus (8 weeks) → infant.

Flow Chart of Female Reproductive System



Homologous parts in male and female reproductive system.

Male	Female
1. Testes	Ovaries
2. Vas deferens	Oviduct
3. Scrotum	Labia Majora
4. Penis	Clitoris

MULTIPLE CHOICE QUESTION

- The onset of menstruation in a human female is called:
 - Menopause
 - Menarche
 - Ovulation
 - Oogenesis

Ans :

SQP 2025

Thus (b) is correct option.

- Assertion (A) :** The foetus respire but does not breathe.
Reason (R) : The maternal blood supplies oxygen to the foetus through placenta.

vas deferens, seminal vesicles, and prostate, play supporting roles in the reproductive system but do not produce reproductive cells.

Thus (d) is correct option.

- 34.** The site of maturation of human sperms is the
- seminiferous tubule
 - interstitial cells
 - prostate gland
 - epididymis

Ans :

MAIN 2023

Sperms mature in the epididymis, where they gain motility and the ability to fertilize an egg. While sperm are produced in the seminiferous tubules, they must mature in the epididymis before being ready for fertilization.

Thus (d) is correct option.

- 35.** The middle piece of sperm provides
- food
 - energy
 - gene
 - chromosomes

Ans :

COMP 2016

The middle piece of a sperm contains numerous mitochondria, which are organelles responsible for producing energy in the form of ATP (adenosine triphosphate). This energy is necessary to power the tail (flagellum) of the sperm for its motility, enabling it to swim toward the egg for fertilization.

Thus (b) is correct option.

- 36.** Ovulation occurs
- at the beginning of menstrual cycle
 - at the end of the menstrual cycle
 - during any time of the menstrual cycle
 - in the mid of the menstrual cycle

Ans :

SQP 2009

Ovulation typically occurs around the middle of the menstrual cycle, usually about 14 days before the start of the next period in a 28-day cycle. During ovulation, a mature egg is released from the ovary, and this is the time when a woman is most fertile. The luteinizing hormone (LH) surge triggers ovulation, and the egg is then available for fertilization by sperm.

Thus (d) is correct option.

- 37.** The gland whose secretion neutralize the acidity of the urethra and vagina
- seminal vesicle
 - Cowper's gland
 - seminiferous tubules
 - prostate gland

Ans :

MAIN 2017

The Cowper's glands (also known as bulbourethral glands) secrete a clear fluid that helps neutralize the acidity of the urethra and vagina, making the environment more suitable for sperm during ejaculation. This fluid acts as a lubricant and protective mechanism for sperm, ensuring its viability as it travels through the reproductive tract.

Thus (d) is correct option.

- 38.** When pregnancy does not occur, the life of corpus luteum is about-
- 4 days
 - 10 days
 - 28 days
 - 14 days

Ans :

SQP 2008

After ovulation, the corpus luteum forms from the ruptured follicle and secretes progesterone to maintain the uterine lining. If fertilization and pregnancy do not occur, the corpus luteum degenerates after about 14 days, leading to a drop in progesterone levels, which triggers the start of menstruation.

Thus (c) is correct option.

- 39.** The middle piece of sperm provides
- energy
 - nucleus
 - locomotion
 - food

Ans :

COMP 2016

The middle piece of the sperm contains a high concentration of mitochondria, which are responsible for producing energy in the form of ATP. This energy is crucial for the movement of the sperm's tail (flagellum), allowing it to swim and reach the egg for fertilization.

Thus (a) is correct option.

- 40.** What is true of gametes?
- they give rise to gonads
 - they are diploid
 - they produce hormones
 - they are haploid

Ans :

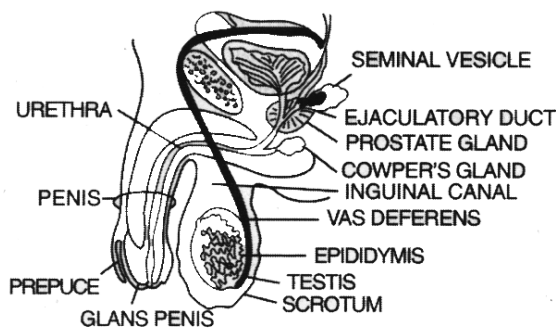
MAIN 2020

Gametes (sperm in males and eggs in females) are haploid, meaning they contain half the number of chromosomes (n) compared to somatic (body) cells, which are diploid (2n). This ensures that when fertilization occurs, the resulting zygote has the correct diploid number of chromosomes, with one set from each parent.

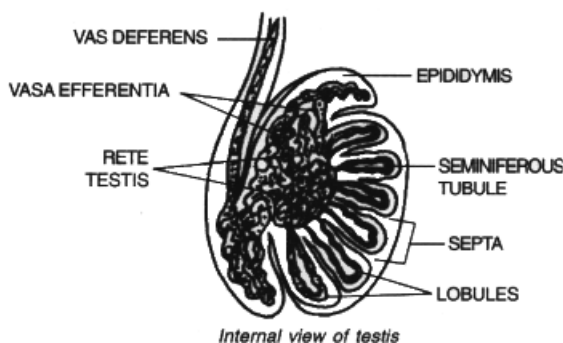
Thus (d) is correct option.

membrane of seminiferous tubule are present sertoli cells which are nutritive and provide nutrition to the developing sperms.

2. **The Epididymis** : Fitting like a cap on the upper pole of the testis. It stores sperms for some days during which they mature and become motile.
3. **Sperm duct (vas deferens)** : The epididymis is continued by the sides of the testis upto its back from where a distinct tube sperm duct arises. It helps to carry sperms.
4. **Accessory glands** : [Seminal vesicles, prostate and cowper's (bulbourethral) gland] helps to contribute to the seminal fluid. The secretion of the glands with sperm or spermatozoa is a whitish viscous fluid known as seminal fluid or semen. The process of expulsion of semen from the urethra is called ejaculation.
5. **A Penis** : Helps in to transfer sperms into the females.
6. **Urethra** : It is contained inside the penis, conveys sperms received from sperm ducts.
7. **Scrotum** : It is a thin pouch of skin that houses the testis. It supports the testes and maintains temperature 2-3° centigrade lower than the body temperature, necessary for the maturation of sperms.



Reproductive system of man



Internal view of testis

3.1 Parts of Sperm

A sperm consists of :

- (i) Head - Consisting of acrosome and nucleus.
- (ii) Neck - Consists of funnel shaped basal body and a pair of centrioles, one proximal and one distal, lying at right angles to each other.
- (iii) Middle piece - Composed exclusively of mitochondria.
- (iv) Tail - Helps in locomotion of sperms.

4. THE FEMALE REPRODUCTIVE SYSTEM

It includes all body organs of female which help in the process of reproduction. It includes :

1. **A pair of Ovaries** : It is the primary female sex organ. Located near the kidneys they remain attached to the lower abdominal cavity through mesovarium by ovarian ligaments. Their peripheral part produces ova. Normally only one egg matures in each ovary every alternate month. A maturing egg in a cellular sac is called follicle. As the egg grows larger follicles also enlarges and gets filled with a fluid and now called as graafian follicle (a matured follicle) which bulges over the surface of ovary for ovulation (rupturing of the follicle and releasing the ovum outside the ovary). The remnant of the follicle persists for sometime to convert into a yellow mass called corpus luteum which continues to secrete oestrogen and progesterone (female sex hormones).
2. **A pair of Oviduct** : Oviduct is also called as fallopian tube or uterine tube. Each oviduct has a funnel shaped opening called oviducal funnel which helps to pick up and push the released ovum into the oviduct. Oviduct receives the ovum and provides appropriate environment for its fertilization and transports it to the uterus.
3. **Uterus** : A hollow pear shaped muscular organ situated in the pelvic cavity between urinary bladder and the rectum. It is commonly called as womb. Its lumen is lined by endometrium which is highly vascular and very rich in glands. The endometrium undergoes marked cyclical changes that constitute the menstrual cycle. The uterus acts as a life support system, the place where fertilized ovum (zygote) becomes implanted (fixed) receives nourishment and develops into an infant.
4. **Cervix** : The lower part of uterus is very narrow and is called cervix or neck. The sperms enter into the uterus through this

51. Fertilization takes place in
 (a) uterus (b) oviduct
 (c) vagina (d) fimbriae

Ans :

COMP 2016

Thus (b) is correct option.

52. Gestation period of human is
 (a) 140 days (b) 250 days
 (c) 170 days (d) 280 days

Ans :

SQP 2013

Thus (d) is correct option.

53. The life of corpus luteum if pregnancy does not occur is
 (a) 14 days (b) 15 days
 (c) 20 days (d) 28 days

Ans :

MAIN 2016

Thus (d) is correct option.

54. The middle piece of sperm has
 (a) mitochondria (b) golgibody
 (c) ribosome (d) ER

Ans :

SQP 2021

Thus (a) is correct option.

55. The structure in the male reproductive system that corresponds to oviduct of the female system is
 (a) seminiferous tubule
 (b) epididymis
 (c) urethra
 (d) vas deferens

Ans :

COMP 2014

Thus (d) is correct option.

56. The onset of menstruation is
 (a) menarche (b) ovulation
 (c) menopause (d) parthenogenesis

Ans :

SQP 2018

Thus (a) is correct option.

ONE MARK QUESTIONS

DIRECTION : Name the following :

57. The structure that connects placenta and the human foetus.

Ans :

SQP 2025, 2024

Umbilical Cord

58. The process of attachment of fertilized ovum to uterine wall.

Ans :

SQP 2024, 2000

Implantation

59. The organ in which foetus develops in a mammalian female.

Ans :

MAIN 1996

Uterus

60. The male reproductive cells of mammals.

Ans :

SQP 1997

Spermatozoa/sperms

61. The part of female reproductive system where fertilization takes place.

Ans :

MAIN 2010 1999

Oviduct

62. The cells of testes that produce male hormones.

Ans :

SQP 2011

Leydig Cells/ Interstitial Cells

63. The fluid surrounding the developing embryo.

Ans :

COMP 2000

Amniotic fluid

64. The structure in which testes are present in man.

Ans :

MAIN 2002

Scrotum

65. The period of intrauterine development of embryo.

Ans :

SQP 2003

Gestation

66. The canal through which testes descend into scrotum just before birth in a human male child.

Ans :

MAIN 2004

Inguinal canal

67. The pituitary hormone which stimulates contraction of uterus during child birth.

Ans :

SQP 2017

Oxytocin

175. The fluid which surrounds the foetus.

Ans : COMP 2018

Amniotic fluid

176. Fixing of developing zygote on the uterine wall.

Ans : MAIN 2015

Implantation

177. The permanent stoppage of menstruation at about the age of 45 years in a female.

Ans : COMP 2015

Menopause

178. A method of contraception in which the sperm duct is cut and ligated.

Ans : SQP 2014

Vasectomy.

DIRECTION : Give the exact location :

179. Amnion

Ans : MAIN 2014, 2011

Membrane, covering the liquid around the foetus in the uterus.

180. Prostate gland.

Ans : SQP 2017

Inferior to urinary bladder encircling urethra.

181. Testis

Ans : MAIN 2019

Inside Scrotum

182. Amniotic fluid

Ans : SQP 2018

Cavity between amnion and embryo

183. Epididymis

Ans : COMP 2018

A knot like structure in the upper portion of testes

184. Seminiferous tubule

Ans : MAIN 2012

Located in the testis.

185. Seminal vesicle

Ans : SQP 2014

Located between the posterior surface of the urinary bladder and the rectum.

DIRECTION : Correct and rewrite the statement by changing the biological term that is underlined for each statement:

186. The protective sac which develops around the developing embryo is called the Pericardium.

Ans : COMP 2019

The protective sac which develops around the developing embryo is called amnion.

DIRECTION : Explain the following term :

187. Parturition.

Ans : SQP 2009

Parturition is the act of expelling the full term foetus from the mothers' uterus at the end of gestation. It is also called as child birth.

DIRECTION : Answer the following :

188. What is the significance of Testes being placed in Scrotal sacs?

Ans : SQP 2025

To maintain an ideal temperature of 2 to 3° C less than body temperature for survival of sperms.

189. What is Parthenocarpy? Give one example.

Ans : SQP 2025

It is development of fruits without fertilization. Apples, tomatoes etc.

190. What is the role played by the inguinal canal?

Ans : MAIN 2013

Inguinal canal allows the testis to descend to the scrotum.

191. Give biological explanations for the following :

The placenta is an important structure for the development of a foetus.

Ans : SQP 2018

Placenta allows diffusion of substances like oxygen, CO₂, hormones, nutrients, excretory products, etc. from the mother to the foetus or from foetus to the mother.

- 90.** A hollow pear-shaped muscular organ where embryo develops.

Ans : COMP 2000
Uterus

- 91.** A female gonad responsible for the production of ova.

Ans : MAIN 2006
Ovary

- 92.** The male hormone produced by the interstitial cells.

Ans : SQP 2008
Testosterone

- 93.** The hormone that stimulates development of secondary sexual characters in males.

Ans : MAIN 2017
Testosterone

- 94.** The hormone that stimulates contraction of uterus during child birth.

Ans : COMP 2018
Oxytocin

- 95.** The structure formed after the release of ovum from Graafian follicle.

Ans : SQP 2013
Corpus luteum

- 96.** The structure formed by the villi of the foetus and the uterus of the mother.

Ans : MAIN 2023
Placenta

- 97.** The part of the female reproductive system where fertilisation takes place.

Ans : SQP 2017
Fallopian tube

- 98.** The male reproductive cells of mammals.

Ans : MAIN 2010
Sperms

- 99.** Name the substances which the foetus receives from the mother through the placenta.

Ans : SQP 2020
Oxygen, glucose, amino acids, etc.

DIRECTION : Choose the right option :

- 100.** Fertilization of human egg normally occurs in the (uterus, fallopian tube, vagina)

Ans : SQP 1996
Fallopian tube

- 101.** The (epididymis, vas deferens, seminal vesicle) store sperms.

Ans : MAIN 2000
Epididymis

- 102.** Sterilization in females involves cutting and tying the (ureter, uterus, urethra, oviduct).

Ans : SQP 2000
Oviduct

- 103.** The site of fertilization in human female is (vagina, oviduct, uterus).

Ans : SQP 2001
Oviduct

- 104.** The onset of menstruation in the female is termed (Ovulation, menarche, menopause, parthenogenesis).

Ans : COMP 2009
Menarche

DIRECTION : Copy and complete the following by filling in the blanks 1 to 5 with appropriate words:

- 105.** The human female gonads are ovaries. A maturing egg in the ovary is present in a sac of cells called _____ (1). As the egg grows larger, the follicle enlarges and gets filled with a fluid and is now called the _____ (2) follicle. The process of releasing the egg from the ovary is called _____ (3). The ovum is picked up by the oviducal funnel and fertilization takes place in the _____ (4). In about a week the blastocyst gets fixed in the endometrium of the uterus and this process is called _____ (5).

Ans : MAIN 2014
(1) Graafian follicle
(2) Corpus luteum
(3) Ovulation
(4) Oviducal funnel
(5) Implantation.

143. Corpus luteum.

Ans : MAIN 2016

Secrete progesterone hormone.

144. Leydig cells.

Ans : SQP 2016

Secrete male sex hormones called Testosterone.

145. Seminal Vesicles.

Ans : SQP 2019

Produces secretion which serves as a medium for transportation of sperms which forms semen.

146. Prostate gland

Ans : MAIN 2013

To produce an alkaline fluid that is a part of semen.

DIRECTION : Structure and functional activity of

147. Corpus luteum and _____

Ans : SQP 2000

Seminiferous tubules and sperms.

148. Seminiferous tubules and _____

Ans : COMP 2010

Seminiferous tubules and sperms.

DIRECTION : Write in logical sequence :

149. Implantation, ovulation, childbirth, gestation, fertilization.

Ans : SQP 2001

Ovulation, fertilization, implantation, gestation, childbirth.

150. Sperm duct, penis, testis, sperms, semen.

Ans : MAIN 2006, 2001

Testis, sperms, sperm duct, semen, penis

151. Graafian follicle, ostium, ovum, uterus, fallopian tube

Ans : COMP 2005

Graafian follicle, ovum, ostium, fallopian tube, uterus.

152. Implantation, fertilization, ovulation, gestation.

Ans : SQP 2006

Ovulation, fertilization, implantation, gestation.

153. Vagina, ovary, uterus, oviduct, cervix, (pathway of egg after ovulation)

Ans : MAIN 2010

Ovary, oviduct, uterus, vagina, cervix.

DIRECTION : Differentiate between the following :

154. Structure of sperm and structure of ovum.

Ans : MAIN 2003

Sperm	Ovum
Motile, consists of head, neck, middle piece and tail.	Non-motile and round in structure.

155. Prostate and cowpers gland (nature of secretion)

Ans : COMP 2004

Prostate gland	Cowper's gland
Alkaline and neutralizes acidic nature of female reproductive tract.	Secretion serves as lubricant.

156. Corpus callosum and corpus luteum (function).

Ans : MAIN 2014

Corpus callosum	Corpus luteum
Connects the two cerebral hemispheres.	Secretion of progesterone hormone.

157. Implantation and gestation (definition)

Ans : SQP 2005

Implantation	Gestation
Fixing of embryo on the wall of uterus.	Full term of development of embryo in uterus (about 280 days).

158. Sperm duct and fallopian tube (function)

Ans : COMP 2016

Sperm duct	Fallopian tube
Sperm duct transports sperms from the epididymis into the urethra.	Fallopian tube is site of fertilization.

Ans :

SQP 2014

False

- 126.** Pregnancy in women can be prevented by vasectomy.

Ans :

MAIN 2016

False

- 127.** Sperm is a single cell.

Ans :

SQP 2014

True

- 128.** One egg is released from each of the two ovaries every month.

Ans :

MAIN 2018

False

- 129.** Menopause is the stoppage of menstruation.

Ans :

SQP 2022

True

- 130.** Amniotic fluid acts as a shock absorber.

Ans :

SQP 2023

True

- 131.** Sperms are produced at body temperature.

Ans :

MAIN 2010

False

DIRECTION : Pick the odd one in following :

- 132.** Ovary, fallopain tube, ureter, uterus.

Ans :

SQP 2000

Ureter

- 133.** Cowper's gland, Urethral gland, Lachrymal gland, Seminal vesicles, Prostrate gland.

Ans :

MAIN 2010

Male accessory glands
Lachrymal gland

- 134.** Prostate gland, Cowper's gland, seminal vesicle, seminiferous tubules.

Ans :

SQP 2018

Odd term – Seminiferous tubule,
Category – Accessory glands of male reproductive system

DIRECTION : Give the functions :

- 135.** Testis

Ans :

MAIN 1996

Produces sperms and male sex hormone testosterone.

- 136.** Scrotum

Ans :

MAIN 1999

Keeps testis at a lower temperature (2°C less than body temperature) thus favouring maturation of sperms.

- 137.** Placenta

Ans :

SQP 2004, 1999

Transfers nutrients, oxygen and antibodies from maternal blood to foetal blood, and removes metabolic wastes. Also acts as an endocrine gland.

- 138.** Acrosome

Ans :

COMP 2000

Entry of sperm into egg is facilitated by release of certain lysosomal enzyme by the acrosome on the head of sperm.

- 139.** Amniotic fluid

Ans :

MAIN 2004

Protects the developing embryo from shocks and injuries.

- 140.** Amnion

Ans :

SQP 2005

Encloses the embryo by forming amniotic cavity which is filled with clean lymph like fluid which cushions and protects the embryo from shock.

- 141.** Seminiferous tubule.

Ans :

COMP 2006, 1992

It is lined internally by germinal epithelium. Some of these epithelial cells function as spermatogonia and give rise to sperms.

- 142.** Corpus luteum

Ans :

SQP 2009

Corpus luteum secretes estrogen and progesterone to prepare the uterus for receiving the embryo. Secretion of progesterone.

Ans :

SQP 1997

The interval of time between implantation and birth is called gestation period.

- 212.** Write the functions of uterus.

Ans :

SQP 2002

It is a sac where embryo develops. Amnion contains amniotic fluid which protect the embryo from shocks and jerks.

- 213.** At the time of birth, how many follicles does a baby female have and how many does a matured human female have?

Ans :

MAIN 2019

8,00,000 follicles at time of birth. 400 mature to discharge ova while others degenerates.

- 214.** What is the significance of amniotic fluid ?

Ans :

SQP 2015

Acts like cushion and protects embryo from shock and injury. Does not allow sticking of embryo with amnion.

- 215.** What are secondary sexual characters?

Ans :

COMP 2017

The male and female sex show externally different visible characteristics. These features are called secondary sexual characters.

- 216.** How does CO₂ and urea excreted by the foetus gets rid off?

Ans :

MAIN 2008

By diffusion, the foetal blood gives off the CO₂ and urea into the mother's blood.

- 217.** Match the column I with column II :

	Column I		Column II
(a)	Scrotal sac	(i)	Maturation of Spermatozoa
(b)	Epididymis	(ii)	Fertilization
(c)	Prostate gland	(iii)	Parturition
(d)	Oviduct	(iv)	Temperature regulation
(e)	Oxytocin	(v)	Alkaline fluid

Ans :

SQP 2002

(a)-(iv), (b)-(i), (c)-(v), (d)-(ii), (e)-(iii).

DIRECTION : Complete the following :

- 218.** An accessory reproductive gland that secretes an alkaline fluid is _____.

Ans :

COMP 2010

prostate gland

- 219.** The part of the ovary that secretes progesterone is _____.

Ans :

SQP 2007

corpus luteum

- 220.** The part of the uterus that thickens each month in preparation for pregnancy is _____.

Ans :

MAIN 2009

endometrium

- 221.** Gestation period in human female is _____ days.

Ans :

COMP 2015

280 days

- 222.** _____ nourishes the embryo inside the womb.

Ans :

MAIN 2000

Placenta

- 223.** The period of complete development of the foetus till birth is called _____.

Ans :

COMP 2006

gestation

- 224.** The canal through which the testis descend into the scrotum just before the birth of a male baby is _____.

Ans :

SQP 2014

Inguinal canal

- 225.** The part where fertilisation occurs in human female _____.

Ans :

COMP 2020

oviduct/fallopian tube

- 226.** The process of development of the sperms in the testis is called _____.

Ans :

SQP 2003

spermatogenesis

- 227.** The follicle which contains the matured ovum is called _____.

159. Testosterone and Oestrogen [organ which secretes.

Ans :

MAIN 2014

Testosterone – Testes

Oestrogen – Ovary

160. Tubectomy and Vasectomy.

Ans :

MAIN 2015

Tubectomy	Vasectomy
Fallopian tube is cut and stitched so that fertilization does not take place.	Vas deferens is cut and both ends are tied to stop the flow of sperm.

161. Prostate gland and Cowper's gland (the nature of secretion).

Ans :

SQP 2010

Prostate gland	Cowper's gland
Prostate gland secretes an alkaline secretion which neutralises the acid in the vagina	Cowper's gland's secretion acts as a lubricant.

162. Gestation and Parturition.

Ans :

SQP 2022

Gestation	Parturition
It is the total time period in which an embryo develops fully inside the uterus.	It is the process of child birth after the gestation period.

163. Graafian follicle and Corpus luteum.

Ans :

SQP 2016

Graafian Follicle	Corpus Luteum
It is a fully developed ovarian follicle containing a mature ovum.	It is a yellow mass formed after the release of an egg from the Graafian follicle which acts as an endocrine gland.

DIRECTION : Give biological term :

164. Cessation of menstruation in females.

Ans :

COMP 1996

Menopause

165. The period of complete intrauterine development of the embryo.

Ans :

SQP 2005

Gestation period

166. Non-identical twins produced by the fertilization of two eggs.

Ans :

MAIN 2008

Fraternal twins

167. Membrane that protects the foetus and secretes a protective fluid.

Ans :

COMP 2010

Amnion

168. The onset of menstruation in a young girl.

Ans :

SQP 2013

Menarche

169. Structure which connects the placenta with the foetus.

Ans :

MAIN 2016

Umbilical cord

170. The canal through which the testes descend into the scrotum just before the birth of a male baby.

Ans :

COMP 2016

Inguinal canal

171. The structure formed by the villi of the embryo and the uterus of the mother.

Ans :

MAIN 2015

Placenta.

172. The accessory gland in human males whose secretion activates the sperms.

Ans :

COMP 2017

Seminal vesicles

173. The kind of twins formed from two fertilised eggs.

Ans :

SQP 2017

Non-identical/Fraternal

174. The onset of menstruation in a young girl.

Ans :

SQP 2018

Menarche

- 68.** Non-identical twins produced by the fertilization of two eggs.
Ans : MAIN 2010
Fraternal twins
- 69.** The structure formed after release of ovum from graafian follicle.
Ans : COMP 2021
Corpus luteum
- 70.** A fluid surrounding the developing embryo.
Ans : MAIN 2023
Amniotic fluid
- 71.** The mucous membrane lining the uterus.
Ans : SQP 2013
Endometrium
- 72.** Two accessory glands of the male reproductive system.
Ans : MAIN 2019
Prostate and Cowper's gland
- 73.** The tubular knot fitting like a cap on the upper surface of the testes.
Ans : MAIN 2005
Epididymis
- 74.** The onset of menstrual cycle in young females.
Ans : SQP 2002
Menarche
- 75.** The membrane that surrounds the foetus and secretes a protective fluid.
Ans : COMP 2009
Amnion
- 76.** The female copulatory organ.
Ans : MAIN 2011
Vagina
- 77.** The male copulatory organ.
Ans : SQP 2016
Penis
- 78.** The structure that produces testosterone.
Ans : SQP 2019
Testis
- 79.** The fully developed part of ovary containing mature egg.
Ans : MAIN 2021
Graafian follicle
- 80.** The accessory gland in human male whose secretion activates the sperms.
Ans : COMP 2023
Seminal vesicle
- 81.** The tubular knot fitting like a cap on the upperside of the testis.
Ans : SQP 2006
Epididymis
- 82.** The period for which the foetus remains inside the uterus.
Ans : MAIN 2009
Gestation
- 83.** The process of delivery of child.
Ans : MAIN 2014
Parturition
- 84.** The site of production of sperm in man.
Ans : COMP 2019
Testis
- 85.** The term used for the stoppage of menstruation.
Ans : MAIN 2004
Menopause
- 86.** The process of fusion of male and female gametes.
Ans : COMP 2016
Fertilisation
- 87.** A muscular wall into which the testis descend.
Ans : SQP 2019
Scrotal sac
- 88.** The innermost foetal membrane which secretes amniotic fluid.
Ans : SQP 2015
Amnion
- 89.** Two substances that diffuse out of the foetus into the placenta.
Ans : MAIN 2003
CO₂, urea

- 192.** Some women have facial hair like beard and moustache. Give reason.

Ans : COMP 2017

The development of facial hair like beard and moustache in some woman is due to the overgrowth of adrenal cortex which produces cortisone. This condition is known as adrenal virilism.

- 193.** What is the significance of amniotic fluid?

Ans : SQP 2015

Amniotic fluid protects the foetus from mechanical injuries.

- 194.** What are the four major parts of the male reproductive system ?

Ans : SQP 2020

Testes, ducts, accessory glands and penis.

- 195.** How many days are required for the maturation of sperms ?

Ans : MAIN 2010

About 10 to 14 days.

- 196.** What structure lines the fallopian tube internally?

Ans : SQP 2008

Ciliated epithelium.

- 197.** What is ejaculatory duct ?

Ans : COMP 2005

The terminal part of the seminal duct formed by the union of vas deferens and secretory duct of the seminal vesicle is called ejaculatory duct.

- 198.** What are fallopian tubes ?

Ans : MAIN 2002

These are pair of slender ducts opening on either side into the uterus.

- 199.** What is vulva ?

Ans : SQP 2000

It is the external female genitalia.

- 200.** What are the components of vulva ?

Ans : COMP 2001

Labia majora, labia minora, clitoris, vestibule, pons pubis.

- 201.** What are the hormones secreted by corpus luteum?

Ans : SQP 2011

Oestrogen, progesterone and relaxin.

- 202.** What is Placenta ?

Ans : COMP 2018

A spongy tissue composed of embryonic and maternal tissue.

- 203.** What are the three major parts of a developing embryo ?

Ans : MAIN 2014

Embryonic disc, amnion and yolk sac.

- 204.** What is colostrums ?

Ans : SQP 2013

It is a thin milky secretion from the nipples produced before and just after child birth.

- 205.** What is colostrums rich in ?

Ans : COMP 2002

It is rich in antibodies, proteins and vitamins.

- 206.** How long does the sperms take to become mature?

Ans : SQP 2021

10 to 14 days.

- 207.** How does placenta acts as an endocrine gland?

Ans : MAIN 2023

Placenta secretes oestrogen and progesterone hormone.

- 208.** What is sperm lysis ?

Ans : COMP 2020

The acrosomes release chemicals called as lysins which help in breaking the cell clusters around the mature ovum.

- 209.** Define the term implantation.

Ans : MAIN 2022

It is the process of attaching the zygote into the uterus wall of the mother.

- 210.** What is inguinal hernia?

Ans : SQP 2013

It is the protrusion of small intestine into the scrotal sacs.

- 211.** What is meant of gestation period ?

DIRECTION : True or false :

- 106.** Gestation is the process of fixing the Zygote to Uterine wall.

Ans : SQP 2011
False (Implantation)

- 107.** Tubectomy involves the cutting and tying of vas deferens in male.

Ans : SQP 1996
False

- 108.** Pregnancy in women can be prevented by the method of vasectomy.

Ans : MAIN 1997
False

- 109.** Fertilization is the product of fusion of egg nucleus and sperm nucleus.

Ans : SQP 2004
True

- 110.** Fertilization of ova in human female occur in the vagina.

Ans : MAIN 1992
False

- 111.** The number of ova produced after a primary oocyte has undergone two maturation divisions is 4.

Ans : COMP 2010
False

- 112.** Gametes are usually produced in specialized structure called gonads.

Ans : SQP 2017
True

- 113.** Seminal vesicles contribute to the fluid substance of the seminal fluid.

Ans : MAIN 2023
True

- 114.** Endometrium is highly vascular and rich in glands.

Ans : SQP 2020
True

- 115.** Fertilization takes place in uterus.

Ans : COMP 2019
False

- 116.** Twelve mature eggs are typically produced by each ovary of a non-pregnant woman in a year.

Ans : SQP 2017
False

- 117.** The female equivalent of the glans of the penis is hymen.

Ans : MAIN 2014
False.

- 118.** Ovulation is the release of sperms from the testis.

Ans : SQP 2018
False

- 119.** Vagina is a muscular tube.

Ans : COMP 2017
True

- 120.** There is mixing of blood between mother blood and the foetus.

Ans : MAIN 2020
False

- 121.** Fertilization occurs in the uterus.

Ans : COMP 2023
False

- 122.** The enlarged mature follicle bursts to release the egg.

Ans : SQP 2018
True

- 123.** Placenta produces certain hormones.

Ans : COMP 2022
True

- 124.** Mother's blood flows into the foetus through placenta.

Ans : MAIN 2000
True

- 125.** Gestation in humans is completed in about 380 days.

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Ans : MAIN 2010
Graafian follicle

228. The process of development of ovum in the ovary is called _____.

Ans : SQP 2013
oogenesis

229. The process of releasing of egg from the ovary is called _____.

Ans : COMP 2017
ovulation

230. The structure of the sperm which helps to penetrate the egg membrane of the ovum is _____.

Ans : MAIN 2020
acrosome

231. The connecting link between the foetus and placenta is called _____.

Ans : SQP 2023
umbilical cord

232. The testosterone hormone is secreted by the _____ cells.

Ans : SQP 2000
interstitial

233. Sperms contains _____ number of chromosomes.

Ans : MAIN 2003
23

234. The shedding out of the endometrium along with blood is called _____.

Ans : SQP 2007
menstruation

235. The expulsion of the foetus from the mother's body is called _____.

Ans : COMP 2021
parturition

236. Man is _____ organism.

Ans : SQP 2017
unisexual

237. The unit of testis is _____.

Ans : MAIN 2012
seminiferous tubule

DIRECTION : State the functions of the following :

238. Seminiferous tubule

Ans : COMP 2018
To produce sperms.

239. Cowper's gland

Ans : SQP 2023
To secrete a fluid which serves as a lubricant.

240. Acrosome

Ans : MAIN 2021
Secretes an enzyme which helps

241. Oviduct

Ans : SQP 2019
Helps to fertilize the egg.

242. Amnion

Ans : MAIN 2020
To protect the embryo.

243. Placenta

Ans : COMP 2014
To exchange the materials like respiratory gases, nutrients respiratory gases, nutrients and urea between mother and foetus.

244. Scrotal sac

Ans : MAIN 2010
To protect the testes and regulate the temperature of testes for spermatogenesis.

245. Vagina

Ans : SQP 2009
To receive the semen (sperms).

246. Male urethra

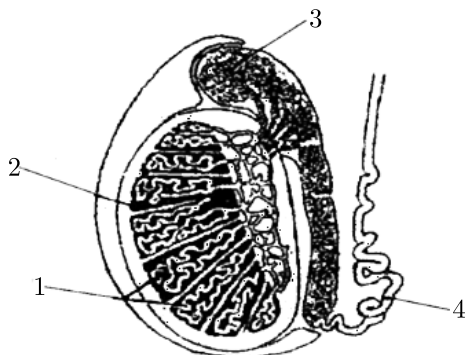
Ans : MAIN 2003
A common passage for urine and semen.

247. Umbilical cord

Ans : SQP 2005
Connects the foetus with placenta and helps in

- (E) Scrotum
 (ii) Vasectomy
 (iii) Sperm duct/Vas deferens
 (iv) Tubectomy
 (v) Oviducts are ligated so that the egg may not meet with the sperms.

310. Given below is a diagram of the lateral section of a testis of a man. Study the same and answer the questions that follow :



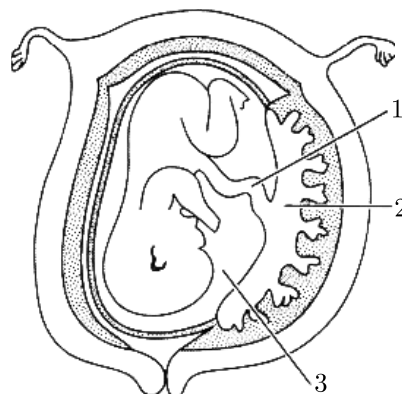
- (i) Label the parts numbered 1 to 4 of the diagram.
 (ii) State the function of the parts labelled 1 and 3.
 (iii) What is the significance of the testes being located in the scrotal sac outside the abdomen?
 (iv) What is the role played by the inguinal canal?
 (v) What is semen ?

Ans :

MAIN 2013

- (i) 1 - Seminiferous tubule
 2 - Lobule
 3 - Epididymis
 4 - Sperm duct (Vas deferens)
 (ii) 1 - Produces sperm by the process called spermatogenesis.
 2 - Store sperms to make them mature and mobile.
 (iii) Since maturation of sperm takes place 2° to 3° lower than the body temperature hence located in the scrotal sac outside the abdomen.
 (iv) It allows the descent of testes into the scrotum.
 (v) Semen is a milky fluid which is the mixture of sperms and secretion from seminal, prostate and Cowper's gland.

311. The diagram given below is that of a developing human foetus. Study the diagram and then answer the questions that follow :



- (i) Label the parts numbered 1 to 3 in the diagram.
 (ii) Mention any two functions of the part labelled 2 in the diagram.
 (iii) Explain the significance of the part numbered 3 in the diagram.
 (iv) Define the term 'Gestation'. What is the normal gestational period of the developing human embryo?
 (v) Mention the sex chromosomes in a male and female embryo.

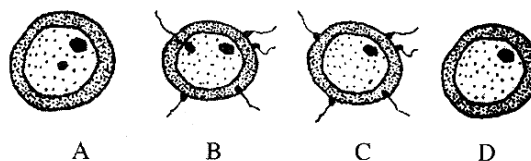
Ans :

MAIN 2016

- (i) 1-Umbilical cord, 2-Placenta, 3-Amniotic cavity full of amniotic fluid.
 (ii) Nutrition, Respiration, Excretion etc.
 (iii) Amniotic fluid prevents desiccation of the foetus. It also prevents the foetus from jerks.
 (iv) Pregnancy or gestation is the process or period of development inside the womb of the mother between conception and parturition in viviparous mammals including humans. Gestation period is + 270 days or about 9 months.
 (v) Sex chromosome in male embryo is XY whereas in female it is XX.

312. Given below are diagrams showing the different stages in the process of fertilisation of an egg in the human female reproductive tract.

Study the diagrams and answer the questions



- (i) Arrange the letters given below each diagram in a logical sequence to show the correct order in the process of fertilisation.

267. Testis is located in the scrotum.

Ans :

SQP 2015

Scrotum protects the testis. It also regulates the temperature of the testis. Sperms need a temperature less than the body temperature for their production and development.

268. Human testis is known as extra abdominal.

Ans :

COMP 2020

Testis are located in a scrotal sacs outside the abdominal cavity. So, testis are called extra abdominal.

TWO MARKS QUESTIONS

269. Mention the surgical methods of contraception in:

- (a) Men
- (b) Women

Ans :

SQP 2025

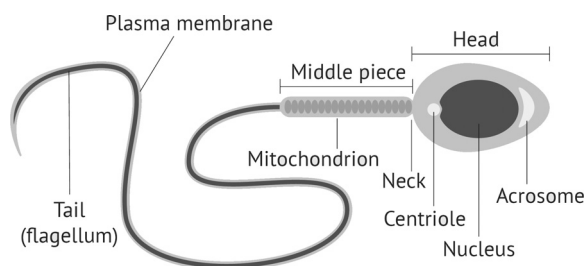
- (a) Vasectomy
- (b) Tubectomy

270. Draw a neat, labelled diagram of a human sperm.

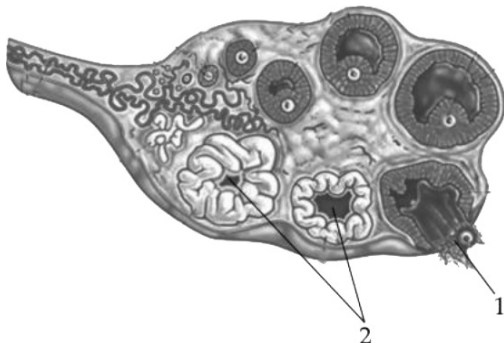
Ans :

SQP 2025

Diagram of human sperm.



271. The diagram given below shows a section of the human ovary.



- (i) Name the process for the release of the part labelled 1.
- (ii) Write the name of the structure marked 2.

Ans :

MAIN 2024

- (i) Ovulation is the process whereby a mature ovarian follicle releases an egg (ovum) into the fallopian tube.
- (ii) The structure marked as 2 is corpus luteum. It develops from the remnants of the ovarian follicle that has released its egg during ovulation.

272. “When an ovum gets fertilized, menstrual cycle stops temporarily in a woman”. Give scientific reason.

Ans :

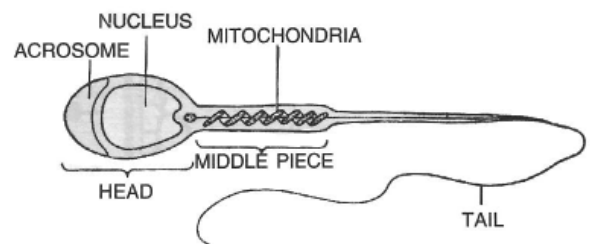
MAIN 2016

When fertilization takes place, the corpus luteum is maintained which secretes large amounts of progesterone hormone. This hormone maintains the endometrium of the uterus and prevents its rupturing. Hence, no menstruation takes place.

273. Draw a diagram of human sperm and label the following parts: head, middle piece, acrosome, mitochondria, tail.

Ans :

SQP 1996



274. Explain briefly :

Most often only one embryo is formed at a time although there are two ovaries in women.

Ans :

MAIN 1996

Normally only one egg matures in each ovary every alternate month. This is the reason that most often only one embryo is formed at a time although there are two ovaries in women.

275. The statement given below is incorrect. Rewrite the correct statement by changing the underlined words of the statement.

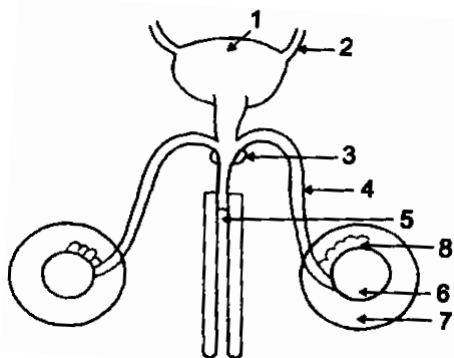
The Graafian follicle, after ovulation turns into a hormone producing tissue called Corpus callosum.

Ans :

COMP 2017

- (i) The foetus gets its nourishment from the mother's blood through the placenta.
- (ii) Uterus.
- (iii) The process by which the ovum is released from the ovary.

296. The diagram given below shows the male urinogenital system of a human being. Study the diagram and answer the questions that follow



- (i) Label the parts numbered 1 to 8.
- (ii) Name the corresponding structure of part (4) in female reproductive system.
- (iii) What is the role of part 7?

Ans :

SQP 2015

- (i) 1 – Urinary bladder
2 – Ureter
3 – Cowper's gland/bulbourethral gland
4 – Vas deferens
5 – Urethra
6 – Testis
7 – Scrotum
8 – Epididymis
- (ii) Oviduct
- (iii) Supports testes and maintains 2°C – 3°C lower than the body temperature for the production of sperms.

297. What is placenta? State its functions.

Ans :

MAIN 2001

It is a disc-shaped structure attached to the uterine wall. It is semi-permeable. Its functions are:

- (a) To provide nutrients to the foetus.
- (b) To transport O_2 to the foetus.
- (c) To remove urea from the foetus.

298. How are test tube babies formed?

Ans :

SQP 2003

If the mother is incapable of conceiving, the mature egg is taken from the ovary and made

to fertilise in a test tube and allowed to develop up to a certain stage. Afterwards, the zygote is placed back in the uterus for further growth. In this way, test tube babies are formed.

299. Given below are name of certain hormones secreted by various parts of a mammalian reproductive system. Write down the site of their secretion.

- (a) Testosterone
- (b) Progesterone
- (c) Relaxin
- (d) Oestrogen

Ans :

MAIN 2009

- (a) Testosterone – Secreted by interstitial cells of testis.
- (b) Progesterone – Secreted by corpus luteum in the ovary.
- (c) Relaxin – Secreted by placenta.
- (d) Oestrogen – Secreted by follicular cells of ovarian follicle.

300. Difference between Sperm and Ovum.

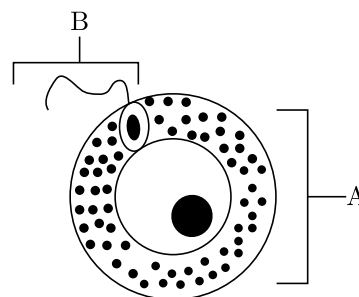
Ans :

SQP 2021

	Sperm		Ovum
(a)	It is the male gamete.	(a)	It is the female gamete.
(b)	It is produced in the testis.	(b)	It is produced in the ovary.
(c)	It is elongated and contains head, tail and middle piece.	(c)	It is round and has three outer layers.

FIVE MARKS QUESTIONS

301. The diagram below represents two reproductive cells A and B. Study the same and then answer the questions that follow :



- (i) Identify the reproductive cells A and B.
- (ii) Name the specific part of the reproductive

289. Embryo and Foetus.

Ans :

MAIN 2001

	Embryo		Foetus
(a)	It is the early stage of development.	(a)	After two months of gestation period, the embryo is called foetus.
(b)	Features are not developed properly.	(b)	It has recognisable appearance of main features of a fully developed human.

290. Identical and Fraternal twins.

Ans :

MAIN 2017

	Identical Twins		Fraternal Twins
(a)	They are produced from one egg.	(a)	They are produced from two eggs.
(b)	They are both boys or both girls.	(b)	They may be both boys or both girls or one boy and one girl.

291. Ureter and Urethra in man.

Ans :

COMP 2005

	Ureter in man		Urethra in man
(a)	It connects the kidney and urinary bladder.	(a)	Common duct for the passage of urine and semen.
(b)	It carries urine to the bladder.	(b)	It carries urine as well as semen to the exterior of the body.

292. Sperm and Semen.

Ans :

MAIN 2023

	Sperm		Semen
(a)	It is the male gamete.	(a)	It is milky alkaline fluid produced by the male reproductive system.
(b)	It is produced by the testis.	(b)	It is produced by the accessory glands.

293. Sexual and Asexual reproduction.

Ans :

SQP 2009

	Sexual Reproduction		Asexual Reproduction
(a)	It involves the gametes.	(a)	No gamete formation.
(b)	Two individuals are needed.	(b)	One individual involves in this type of reproduction.

294. State the difference between identical and fraternal twins.

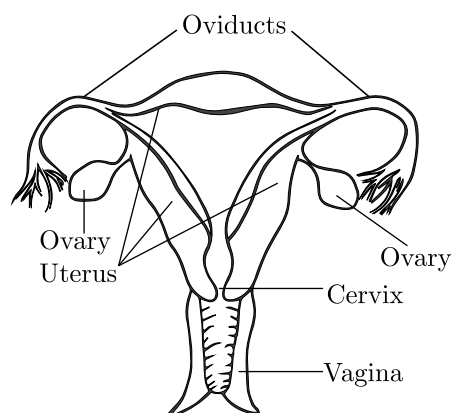
Ans :

COMP 2022

Identical twins are formed by splitting of a fertilized egg and that separates into two equal parts. They may be both boys or both girls (same sex). They share a common placentas.

Fraternal twins are formed by two eggs fertilized by two sperms at a time. They may be both boys, both girls or one boy or a girl. They have two separate placentas.

THREE MARKS QUESTIONS

295. The figure below represents the female reproductive organs of the humans :

- How does the human embryo developing in the uterus obtain its nourishment ?
- Which structure protects and nourishes the developing embryo ?
- Define ovulation.

Ans :

MAIN 1995

The Graafian follicle, after ovulation turns into a hormone producing tissue called Corpus luteum.

- 276.** Given below are sets of five terms each. Rewrite the terms in correct order in a logical sequence.
Example : Large intestine, Stomach, Mouth, Small intestine, Oesophagus.

Answer : Mouth → Oesophagus → Stomach → Small intestine → Large intestine.
Uterus, Parturition, Fertilisation, Gestation, Implantation.

Ans : SQP 2017
Fertilisation, Uterus, Implantation, Gestation, Parturition.

- 277.** What is sexual reproduction ?

Ans : COMP 2009
The process of reproduction in which a male gamete unites with the female gamete to form a zygote which develops into a new individual is called reproduction.

- 278.** State the functions of testis.

Ans : SQP 2003
(a) To produce sperms.
(b) To produce male sex hormones.

- 279.** State the functions of ovary.

Ans : MAIN 2000
(a) To produce the ova.
(b) To produce female sex hormones.

- 280.** Where are the male and female gametes produced?

Ans : SQP 2002
Male gametes are produced in the testis. Female gametes are produced in the ovaries.

- 281.** Name two surgical techniques for male and female that are used to prevent pregnancy.

Ans : COMP 2018
Vasectomy – in male.
Tubectomy – in female.

- 282.** How are test tube babies formed ?

Ans : SQP 2020
Normal conception is not possible in some women. In such cases, ovum is taken and fertilized by the sperm in a test tube and when it reaches 32 cell stage, it is implanted inside the uterus of the mother for future development of the child.

- 283.** State the role of testosterone.

Ans : COMP 2020
Testosterone helps in the development of secondary sexual character such as increase in height, growth of hairs on the face etc. enlargement of genital organs etc.

- 284.** What is the significance of human testis being located in the scrotum?

Ans : MAIN 2006
Scrotum protects the testis. It also regulates the temperature of the testis. Sperms need a temperature less than the body temperature for their production and development.

- 285.** What is vasectomy and tubectomy?

Ans : SQP 2019
Vasectomy is the cutting and ligating of vasa deferentia to sterilize men for birth control. Tubectomy is the cutting and ligating the oviducts in females. This surgical methods do not allow the fertilization of sperm and ova.

- 286.** What is umbilical cord?

Ans : COMP 2016
It is cord-like structure connecting the foetus and the placenta. Through the umbilical cord the embryo is getting glucose, oxygen and it also removes urea, CO₂, etc from the embryo.

- 287.** How is embryo protected inside the uterus ?

Ans : MAIN 2010
The embryo is surrounded by embryonic membrane called amnion. The cavity between the foetus and amnion contains amniotic fluid which acts as a shock absorber. It protects the embryo from mechanical jerks.

DIRECTION : Difference between them:

- 288.** Menarche and menopause.

Ans : MAIN 2012

	Menarche		Menopause
(a)	It is the onset of menstruation in a female.	(a)	It is the complete stoppage of menstruation.
(b)	It occurs around the age of 13 years.	(b)	It occurs around age of 55 years.

system where the above cells are produced.

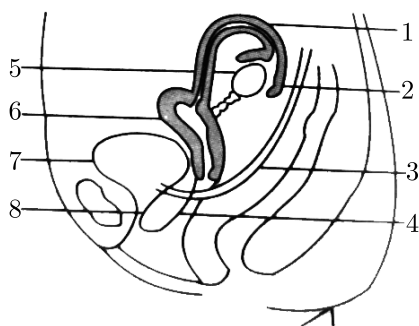
- (iii) Where in the female reproductive system do these cells unite ?
- (iv) Name the main hormones secreted by the (1) ovary (2) testes.
- (v) Name an accessory gland found in the male reproductive system and state the function of its secretion.

Ans :

SQP 2011

- (i) A – Ovum
B – Spermatozoa
- (ii) Follicles of ovary → ovum
Seminiferous tubules in testes → sperm
- (iii) Fallopian tube
- (iv) Estrogen, Progesterone
- (v) Testosterone

- 302.** The following diagram represents the ventral view of the female reproductive system :



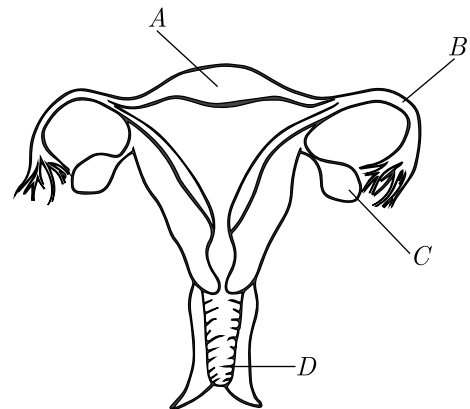
- (i) Label the parts indicated by guidelines 1 - 8.
- (ii) How does the uterus prepare for the reception of a zygote ?
- (iii) What happens to the uterus if fertilization takes place ?
- (iv) What happens to the uterus if fertilization has failed to take place ?

Ans :

MAIN 1998

- (i) 1. Oviduct; 2. Funnel of oviduct ; 3. Ureter; 4. Vagina; 5. Ovary; 6. Uterus ; 7. Urinary bladder; 8. Urethra.
- (ii) The wall of uterus get thickened and richly supplied with blood capillaries to receive the zygote.
- (iii) The wall of uterus further becomes more thickened and gets intensely supplied with blood capillaries and the embryo is attached to uterine wall after 7 days of fertilisation.
- (iv) The endometrium breaks down and causes discharge of blood and mucous resulting in menstruation.

- 303.** The figure given below represents the female reproductive system of a mammal. Parts indicated by the guidelines A to D are as follows :
Give appropriate term for each of the following :



- (i) The onset of reproductive phase in a young female.
- (ii) Rupture of follicle and release of ovum from the ovary.
- (iii) Monthly discharge of blood and disintegrated tissues in human female.
- (iv) Process of fusion of ovum and sperm.
- (v) Fixing of developing zygote (blastocyst) on the uterine wall.

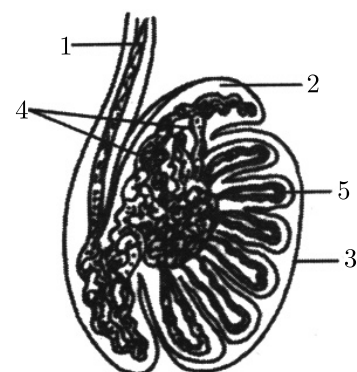
Ans :

MAIN 1998

- (i) Menarche (Puberty)
- (ii) Ovulation
- (iii) Menstrual phase, endorment of uterus
- (iv) Fertilization
- (v) Implantation

- 304.** The diagram given below is one of the system in the male human body :

- (i) Write down the name of the organ in the system.
- (ii) Label guidelines '1' to '5'.
- (iii) Write down the functions of guideline numbered 2 and 5.

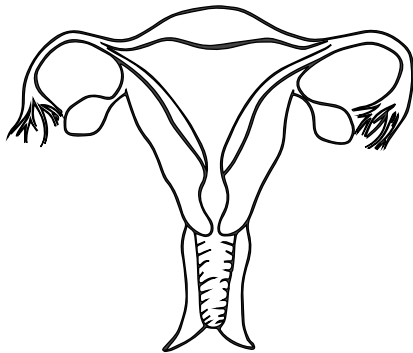


Ans :

SQ 2005

- (i) It is a vetical section of a testis.
- (ii) 1. Sperm duct (Vas deferens).
2. Epidermis.
3. Tunica albuginea
4. Vasa Efferentia or Collecting ducts.
5. Seminiferous tubules
- (iii) No 2. (Epididymis) – It is a tube-like structure which is firmly attached to the testis. The seminiferous tubules open into it through ducts. Epididymis is the chief store place of spermatozoa.
- No 5. (Seminiferous tubules) – They are coiled structures and are involved in the formation of spermatozoa. The seminiferous tubules form a network at the anterior end of the testis.

305. Given below is a diagrammatic representation of the female reproductive system :

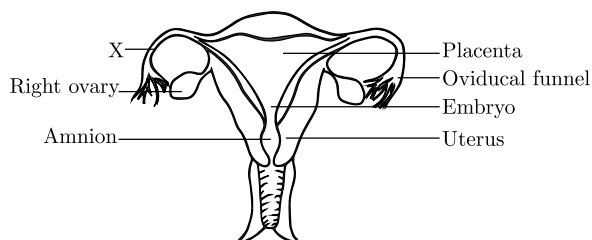


- (i) Redraw the same on your answer-sheet and then fill in and label the following parts :
(1) Right ovary (2) Uterus (3) Placenta
(4) Embryo (5) Amnion (6) Oviducal funnel.
- (ii) State the function of the :
(1) Placenta
(2) Amniotic fluid.
- (iii) Using the symbol 'X' indicates the region in the diagram where fertilization occurs.
- (iv) Differentiate between identical twins and fraternal twins.

Ans :

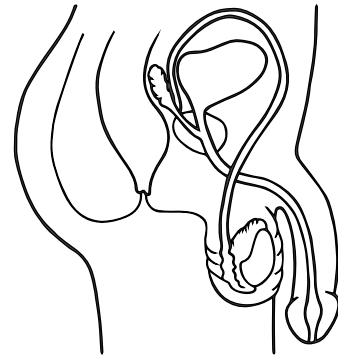
COMP 2004

(i)



- (ii) (1) Placenta – Exchange of gases and digested food.
(2) Amniotic fluid – Protects foetus from jerks/ shocks.
- (iii) X– is fallopian tube (marked in diagram).
- (iv) Identical twins – Develop from single egg after fertilization.
Fraternal twins – from two separate eggs.

306. Given below is the outline of the cross-section of the male reproductive system.

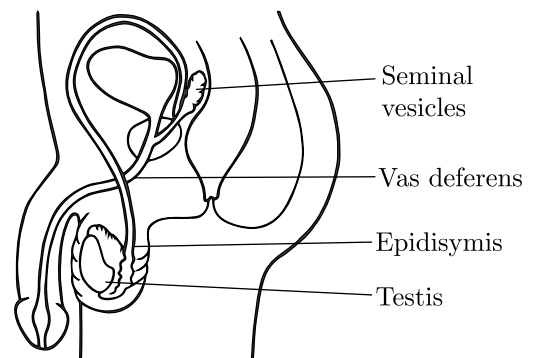


- (i) Copy the outline onto your answer-sheet in pencil and label the following parts-testis, epidermis, seminal vesicles, vas deferens.
- (ii) Name the hormone produced by the testis.
- (iii) Why are sperms produced in large numbers ?
- (iv) State the function of the seminal vesicles.

Ans :

MAIN 2003

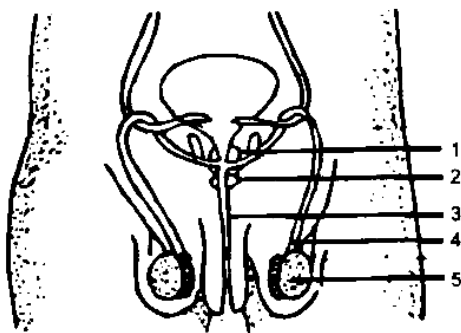
(i)



- (ii) Testosterone.
- (iii) Low count of sperms causes infertility because large number of sperms go astray.
- (iv) Seminal vesicles produce a secretion which serves as a medium for the movement of sperms towards the female oviduct.

307. Given below is the outline of the male reproductive system :

- (i) Name the parts labelled 1 to 5.
- (ii) State the functions of the parts labelled 1 and 4.
- (iii) Name the cells of part 5 that produce testosterone.
- (iv) Why is the structure 5 present outside the body in the scrotal sacs ?
- (v) What is semen ?

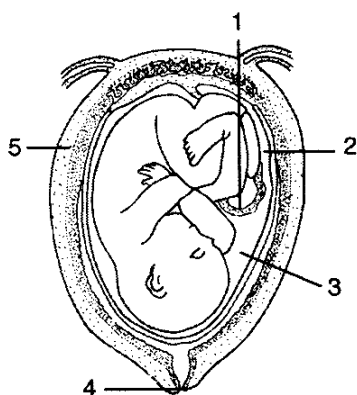


Ans :

COMP 2010

- (i) (1) Seminal vesicle (2) Prostate gland (3) Urethra (4) Sperm duct (vas deferens) (5) Testis
- (ii) Function : Part-1 : It produces a secretion which serves as a medium for transportation of the sperms. The mixture of this fluid and sperms, produce a milky fluid called semen.
Part-4 : It helps in the transport of mature sperms.
- (iii) Leydig's cells or interstitial cell.
- (iv) It helps in temperature regulation in the testes $2 - 3^{\circ}\text{C}$ lower than that of body. The regulation is brought by loosening or contraction of the skin of scrotum wall.
- (v) It is a milky fluid produced by the mixing of sperms and secretion of seminal vesicles.

308. The diagram given below is that of a developing human foetus in the womb. Study the same and then answer the questions that follow :



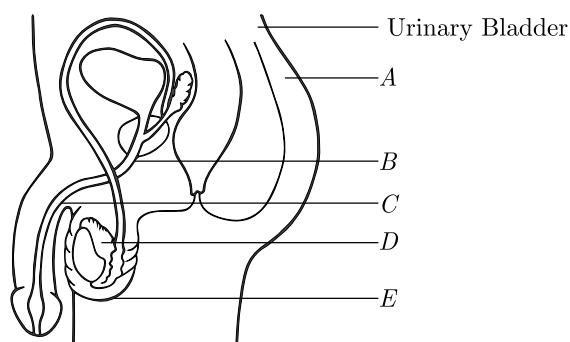
- (i) Name the parts '1' to '5' indicated by guidelines.
- (ii) What term is given to the period of development of the foetus in the womb ?
- (iii) How many days does the foetus take to be fully developed ?
- (iv) Mention two functions of the parts labelled '2' other than its endocrine function.
- (v) Name the hormone (any one) produced by the part labelled '2'.
- (vi) Name the function of part labelled '3'.

Ans :

SQP 2002

- (i) (1) Umbilical cord,
(2) Placenta,
(3) Amniotic fluid,
(4) Cervix,
(5) Uterine wall.
- (ii) Gestation.
- (iii) 280 days.
- (iv) Provides diffusion of respiratory gases between mother and foetus, removes urea produced by foetus.
- (v) Progesterone
- (vi) Absorbs shocks.

309. The diagram below represents a surgical sterilization method in males. Study the same and answer the questions that follow :



- (i) Name the parts marked A, B, C, D and E.
- (ii) Give the name of the surgical method represented in the diagram.
- (iii) Which part is ligated or cut ?
- (iv) Name the corresponding surgical method conducted in females.
- (v) Name the part which is ligated in females and why?

Ans :

MAIN 2009

- (i) (A) Seminal vesicle
(B) Sperm duct/vas deferens
(C) Urethra
(D) Seminiferous tubule of testis

transportation of substances from placenta to foetus and vice versa.

248. Leydig cells

Ans : MAIN 2015

To produce testosterone.

249. Sperm duct

Ans : COMP 2002

To transport sperms from the testis.

250. Scrotal sac

Ans : SQP 2017

To protect the testis and also to regulate the temperature of the testis for sperm production.

251. Testis

Ans : MAIN 2000

To produce the sperms.

252. Uterus

Ans : MAIN 2013

To protect and to provide nutrition to the developing embryo.

253. Corpus luteum

Ans : SQP 2018

To act as an endocrine gland which produces progesterone.

254. Amniotic fluid

Ans : COMP 2019

Acts as a shock absorber and protects the foetus from mechanical shocks.

255. Placenta

Ans : MAIN 2023

To exchange the materials like respiratory gases, nutrients and urea between the mother and foetus.

256. Epididymis

Ans : SQP 2001

To store the sperms.

257. Amnion

Ans : COMP 2004

To protect the embryo.

258. Seminiferous tubules

Ans : SQP 2007

The site where sperm is actually produced in the testis.

259. Cowper's gland

Ans : MAIN 2009

To secrete a fluid which serves as a lubricant.

260. Seminal vesicle

Ans : COMP 2011

It secretes a fluid which activates the sperm.

261. Urethra in man

Ans : SQP 2014

It is a common passage for urine and semen.

DIRECTION : Find odd one out in the following :**262. Ureter, urethra, oviduct, ovary.**

Ans : MAIN 2019

ureter

263. Vagina, vulva, seminal vesicle, uterus.

Ans : SQP 2017

seminal vesicle

264. Epididymis, vas deferens, seminiferous tubule, ovum, urethra.

Ans : COMP 2012

ovum

265. Fertilization, implantation, gestation, sperm, ovum.

Ans : MAIN 2020

sperm

DIRECTION : Give reasons:**266. Twins may or may not be identical.**

Ans : MAIN 2010

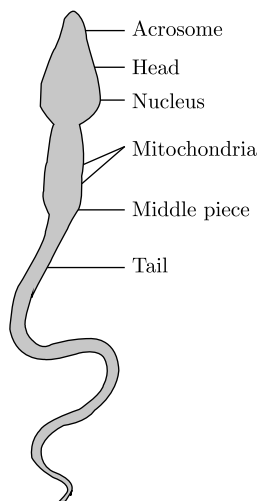
Twins are formed according to the number of eggs released in the oviduct. If two eggs are available at a time, both may get fertilised and form fraternal twins. If the zygote of a single egg splits and separates into two equal parts then identical twins are formed.

- (ii) Where does fertilisation normally take place ? What is 'Implantation' that follows fertilisation?
- (iii) Mention the chromosome number of the egg and zygote in humans.
- (iv) Explain the term 'Gestation'. How long does Gestation last in humans ?
- (v) Draw a neat, labelled diagram of a mature human sperm.

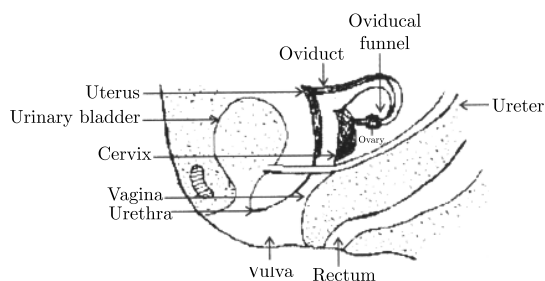
Ans :

SQP 2018

- (i) DCBA [It can also be CBAD as there is not a clear difference between egg cell and zygote]
- (ii) In the fallopian tube (Oviduct). Attachment of blastocyst/embryo/fertilized ovum in the uterine wall (endometrium) of mother.
- (iii) Egg – 23
Zygote – 46
- (iv) Duration of embryonic development in the uterus starting from implantation upto the birth of a child. Gestation lasts in human for 280 days.
- (v)



- 313.** The diagram given here represents the organs of female reproductive system:



- (i) Name the fully developed part of ovary containing the ovum.

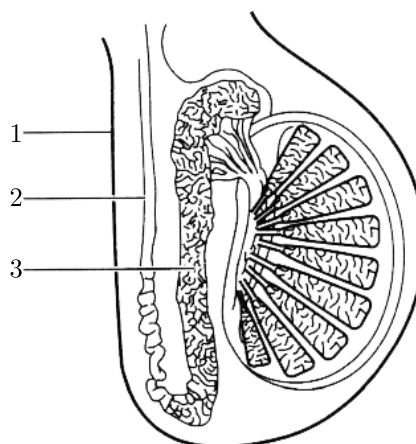
- (ii) Name the organ of the female body in which the foetus develops.
- (iii) Name the part homologous to penis of male.
- (iv) What is ovulation ?
- (v) Which two hormones are secreted by ovary ?

Ans :

COMP 2017

- (i) Graafian follicle
- (ii) Uterus
- (iii) Clitoris
- (iv) The process by which the matured ovum discharges from the ovary.
- (v) Oestrogen and progesterone.

- 314.** The diagram shown below is the longitudinal section of a testis of man. Study it carefully and answer the question that follow :



- (i) Label the parts numbered 1 to 3 in the diagram.
- (ii) In which part of the testis are the sperms produced?
- (iii) State the functions of the parts labelled 1 and 3 in the diagram.
- (iv) Name the cells that secrete Testosterone.
- (v) Draw a neat, labelled diagram of a sperm.

Ans :

MAIN 2019

- (i) 1. Scrotum
2. Sperm duct/vasa deferens
3. Epididymis
- (ii) Seminiferous tubules.
- (iii) Scrotum : Brings the temperature 2 - 3 °C for the maturation of sperms.
Epididymis : Store the sperms and help in their maturity.
- (iv) Leydig's cells.
- (v)

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Parts indicated by guidelines A to D are as follows:
A - Uterus, B - Fallopian tube, C - Ovary, D - Vagina

Give appropriate terms for each of the following:

- The onset of reproductive phase in a young female.
- Rupture of follicle and release of ovum from the ovary.
- Monthly discharge of blood and disintegrated tissues in human female.
- Process of fusion of ovum and sperm.
- Fixing of developing zygote on the uterine walls.
- Which part of female reproductive system receive semen?

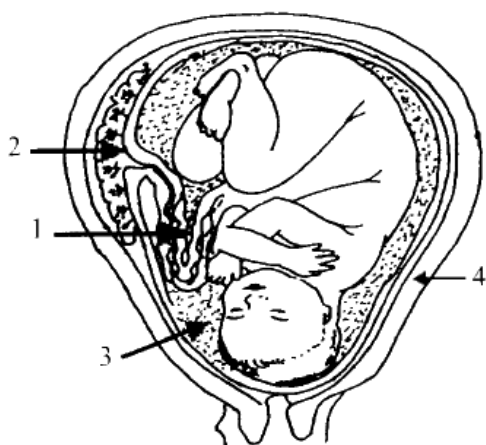
Ans :

MAIN 2015

- Menarche
- Ovulation
- Menstruation
- Fertilisation
- Implantation
- Vagina

326. Given figure shows a foetus in a uterus:

- Label the parts 1-4 on the diagram.
- Why is amniocentesis test done?
- Briefly explain how a mammalian embryo is protected, nourished and how it respire.



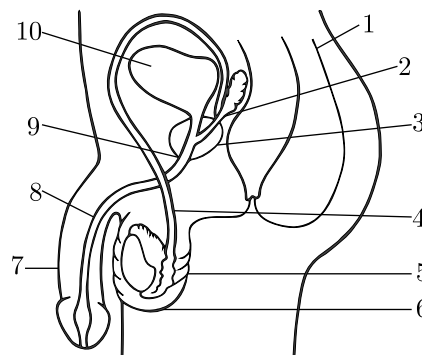
Ans :

SQP 2007

- 1 - Umbilical cord; 2 - Placenta; 3 - Amniotic fluid; 4 - Uterus wall
- It is a technique to find out whether there is any kind of foetal abnormalities.
- An embryo gets its nutrients from the mother's blood through the placenta. Also it gets O_2 from the mother's blood. It is protected by placenta and amnion. The

amniotic fluid present in between the amnion and the embryo acts as a shock absorber.

327. The figure below represents the male reproductive system of a human being:



(i) Label parts 1-10.

(ii) State one function each of the following:

1 - Testis; 2 - Penis; 3 - Scrotal sac; 4 - Prostate gland; 5 - Seminal vesicle.

Ans :

COMP 2012

- Ureter;
 - Prostate gland;
 - Seminal vesicle;
 - Vas deferens;
 - Epididymis;
 - Testis;
 - Penis;
 - Urethra;
 - Cowper's gland;
 - Pubis.
- Testis - Production of sperms.
 - Penis - Deposition of semen into the female's vagina.
 - Scrotal sacs - To keep the temperature less than body temperature for production of sperms/ protection of testis.
 - Prostate gland - To secrete an alkaline fluid into the semen.
 - Seminal vesicle - To secrete a white fluid for the transportation of sperms.

328. Complete the following statements :

- The cell formed through fertilization is called (gamete, sperm cell, zygote, ovum).
- Which of the following organs develop first ? (liver, heart, kidneys, notochord).
- How old is the embryo when it becomes a foetus ? (2 weeks, 2 months, 5 months, 28 days).
- The mammalian ovum was discovered by (Hertwig, Von Baer, Schwann, Satoh).

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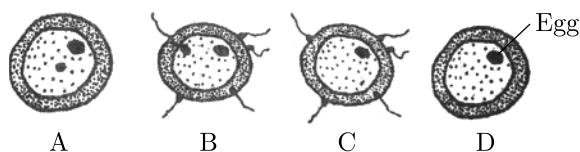
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Ans :

SQP 2007

- (i) 1. Placenta
2. Chorion
- (ii) Amniotic fluid acts as a shock absorber and thus gives protection to the foetus.
- (iii) Umbilical cord contains umbilical artery and umbilical vein which acts as a string that connects foetus with the placenta and thus provides nourishment and takes away wastes from the foetus.
- (iv) Placenta.

318. Given below are diagrams showing different stages in the process of fertilisation of an egg in the female reproductive tract:

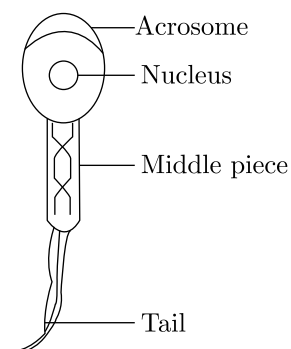


- (i) Use the alphabet given below each diagram to show the correct order in the process of fertilisation.
- (ii) Where in the female reproductive system does this process normally take place?
- (iii) What is the biological term for the product of fusion?
- (iv) What is the chromosome number of (1) the egg (2) the fused product?
- (v) Draw a neat labelled diagram of a mature human sperm.

Ans :

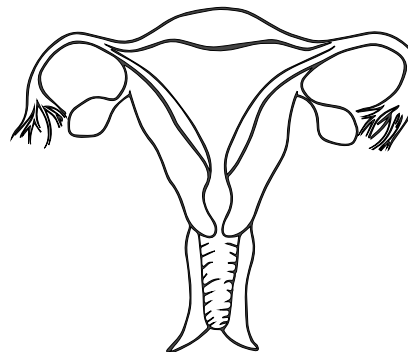
MAIN 2007

- (i) D → B → C → A.
- (ii) Fallopian tube/Oviduct.
- (iii) Zygote
- (iv) (1) 23, (2) 23 pairs.
- (v)



319. Given below is a diagrammatic representation of the ventral cross-sectional view of the female reproductive system:

- (i) Redraw the same on your answer sheet and label the following parts:

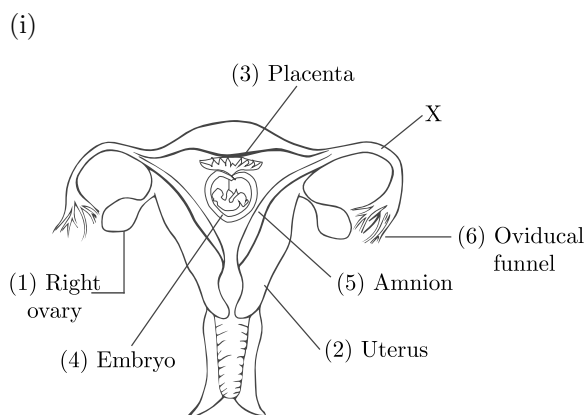


- (1) Right ovary (2) Uterus
- (3) Placenta (4) Embryo
- (5) Amnion (6) Oviducal funnel.

- (ii) State the function of the following:
(1) Placenta; (2) Amniotic fluid.
- (iii) Using the symbol 'X' indicate the region in the diagram where fertilisation occurs.
- (iv) Differentiate between identical twins and fraternal twins.

Ans :

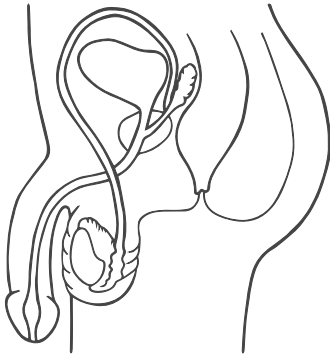
SQP 2000



- (ii) 1 – Placenta: Diffusion of respiratory gases, digested food and excretory material between mother and foetus.
2 – Amniotic fluid: Protects the foetus from shocks and mechanical jerks.
- (iii) X – marked is oviduct/fallopian tube.
- (iv) Identical twins form by splitting of a fertilised egg equally into two and have a common placenta.
Fraternal twins form from two separate fertilised eggs and have placenta of their own.

320. Given diagram is the outline of the cross section of the male reproductive system:

- (i) Copy the outline on to your answer sheet in pencil and label the following parts – testis, epididymis, seminal vesicles, vas deferens.

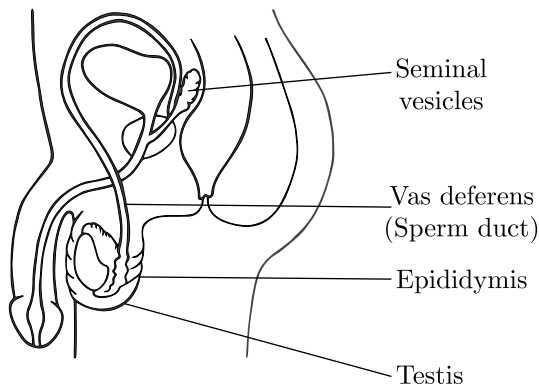


- (ii) Name the hormone produced by the testis.
 (iii) Why are sperms produced in large numbers?
 (iv) State the function of the seminal vesicles.

Ans :

COMP 2023

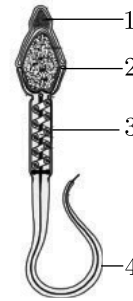
(i)



- (ii) Testosterone
 (iii) The ovum in mammals does not exert any chemical attraction on the sperms, hence to ensure the fertilisation of the ovum it is essential that large number of sperms are produced.
 (iv) Seminal vesicle produces secretion which serves as a medium for transportation of sperms, activates the sperms, neutralises acidic environment of the urethra.

321. The diagram refers to the structure of human sperm:

- (i) Label the part 1-4.
 (ii) What are the number of chromosomes present in the nucleus of the sperm?
 (iii) State the functions of part 1,3 and 4.
 (iv) Where is sperm produced in man?

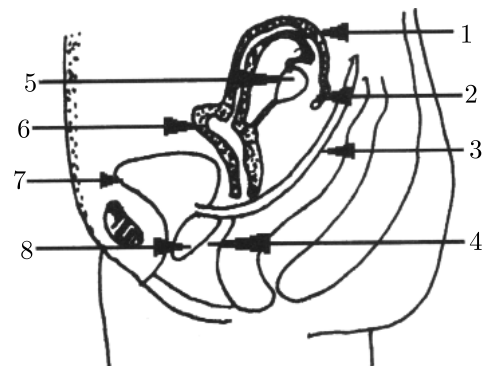


Ans :

MAIN 2021

- (i) 1 – Acrosome;
 2 – Nucleus containing chromosomal material;
 3 – Mitochondria;
 4 – Tail
 (ii) 23 chromosomes are present in sperms.
 (iii) Part 1 - Acrosome – To secrete an enzyme, which helps the sperm to penetrate into the egg.
 Part 3 - Mitochondria – It produces energy for the mobility of the sperm.
 Part 4 - Tail – By the lashing movement of it, the sperm can move forward.
 (iv) Sperms are produced by the germinal epithelium of seminiferous tubules of the testis.

322. The diagram given below represents the ventral view of the female reproductive system:



- (i) Label the parts indicated by guidelines 1-8.
 (ii) What happens to the uterus if fertilisation takes place?
 (iii) What happens to the uterus if fertilisation has failed to take place?

Ans :

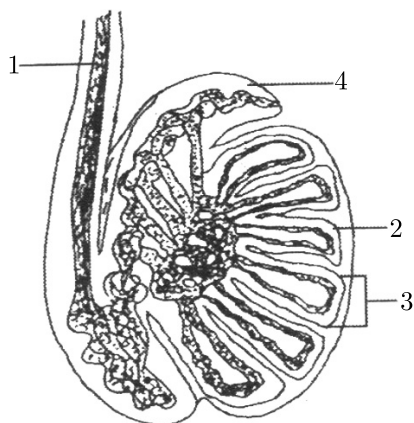
SQP 2004

- (i) 1 – Oviduct;
 2 – Funnel of oviduct;
 3 – Ureter;
 4 – Vagina;

- 5 – Ovary;
6 – Uterus;
7 – Urinary bladder;
8 – Urethra.

- (ii) The wall of uterus thickens and is supplied with blood capillaries.
(iii) The endometrium breaks down and causes discharge of blood and mucus.

323. The diagram shown is the Lateral Section of a testis of man.



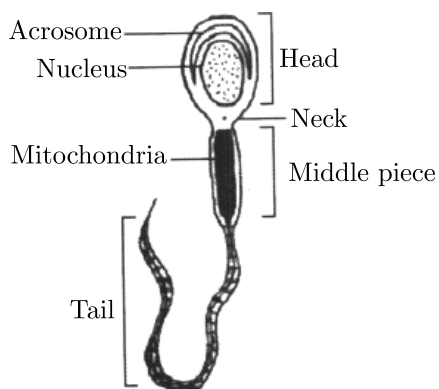
Study it carefully and answer the questions that follow:

- (i) Label the parts 1 to 4 of the diagram.
(ii) State the functions of the parts labelled 1 and 2.
(iii) Draw a labelled diagram of a sperm.

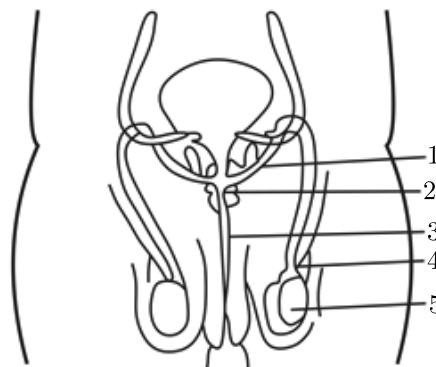
Ans :

MAIN 2013

- (i) 1 – Vas deferens
2 – Seminiferous tubule
3 – Testicular lobules
4 – Epididymis
(ii) Part 1 – To transport sperms.
Part 2 – Production of sperms.
(iii)



324. The figure shows the male urinogenital system in mammals. Observe the diagram and answer the following:



- (i) Label the parts 1-5.
(ii) Where are the seminiferous tubules located?
(iii) In which tissue does the sperm mature?
(iv) How does the sperm differ from an ovum?

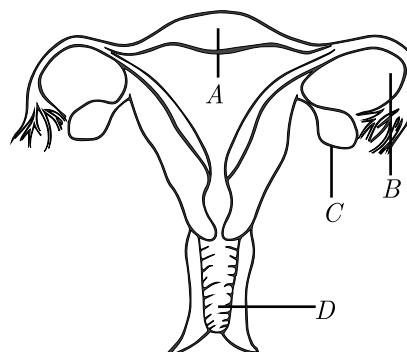
Ans :

SQP 2002

- (i) 1 – Prostate gland;
2 – Cowper's gland;
3 – Urethra;
4 – Sperm duct;
5 – Testis.
(ii) Seminiferous tubules are located in the testis.
(iii) The sperm matures in epididymis.
(iv)

	Sperm		Ovum
(a)	It is the male gamete.	(a)	It is the female gamete.
(b)	It is motile.	(b)	It is non-motile
(c)	It has a tail.	(c)	Tail is absent.

325. The figure given below represents the female reproductive system of a mammal:



Most cave paintings are linked to Cro-Magnon man, early modern humans known for creating detailed art depicting animals and hunting scenes, such as those found in Lascaux and Altamira caves.

Thus (b) is correct option.

5. Death rate is the number of death
- Per hundred people per year
 - Per hundred people per decade
 - Per thousand people per decade
 - Per thousand people per year

Ans :

SQP 2011

The death rate measures the number of deaths per thousand people per year. This standard unit helps compare mortality rates across populations. It is commonly used to assess public health and population trends.

Thus (d) is correct option.

6. Population changes occur due to the movement of individuals. Emigration specifically involves individuals leaving a population. Emigration refers to number of individuals
- Moving into a population
 - Born in a population
 - Added to population growth
 - Moving out of population

Ans :

MAIN 2013

Emigration refers to the process where individuals move out of a particular population to settle in a different area. It is one of the factors that decrease the size of a population. Conversely, immigration is when individuals move into a population, increasing its size.

Thus (d) is correct option.

7. The human ancestor who has a cranial capacity of 850-1000 cc.
- | | |
|------------------|------------------|
| (a) Homo Habilis | (b) Cro-Magnon |
| (c) Homo sapiens | (d) Homo erectus |

Ans :

SQP 2015

Homo erectus is the human ancestor known to have a cranial capacity ranging between 850-1000 cc. This species is considered an important stage in human evolution, as it displayed significant advancements in tool-making and perhaps early forms of social organization. Other species like Homo habilis had a smaller cranial capacity (around 500-800 cc), while Homo sapiens and Cro-Magnon had much larger cranial capacities

Thus (d) is correct option.

8. The name Homo Sapiens can be assigned to
- Cro-Magnon man
 - Peking man
 - Shivalik man
 - Java man

Ans :

SQP 2015

Cro-Magnon man is an early modern human and is classified under Homo sapiens. They lived in Europe around 40,000 to 10,000 years ago and had a physical appearance similar to modern humans. The other options, such as Peking man (Homo erectus), Shivalik man, and Java man (Homo erectus), are earlier human ancestors, not classified as Homo sapiens.

Thus (a) is correct option.

9. The false statement about Cro-Magnon man is
- He walked erect and was swift.
 - His cranial cavity was less than Homo sapiens.
 - He was intelligent and cultured.
 - He started metal work, painting and farming.

Ans :

MAIN 2021

This statement is false because Cro-Magnon man had a cranial capacity that was equal to or even slightly larger than modern Homo sapiens. They were intelligent, walked erect, and are known for their cultural advancements, including art and early forms of agriculture.

Thus (b) is correct option.

10. Identify a non-renewable natural resource that is overexploited due to increased population.
- | | |
|----------------------|----------|
| (a) Petroleum | (b) Coal |
| (c) Both (a) and (b) | (d) Wind |

Ans :

SQP 2023

Both petroleum and coal are non-renewable natural resources that are heavily overexploited due to the growing population and increased industrial activities. These fossil fuels are finite in supply and take millions of years to form, making their overuse a serious concern for future energy sustainability.

Thus (c) is correct option.

11. When the environmental resistance is negligible and there is plenty of food and space, the population would show
- Zero growth curve
 - J-shaped growth curve
 - Sigmoid growth curve
 - none of the above

- (v) The acrosome of sperm contains (hydrolytic enzymes, mitochondria, DNA, RNA).

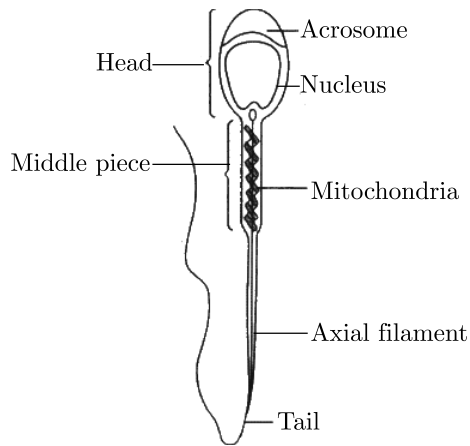
Ans :

SQP 2004

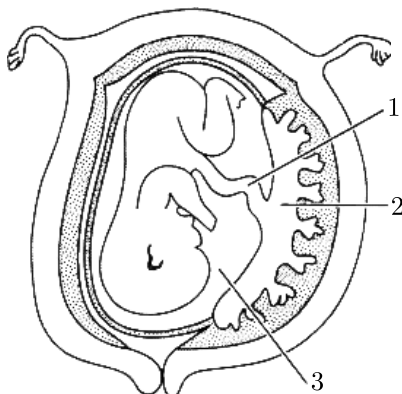
- (i) Zygote
- (ii) Notochord
- (iii) 2 months
- (iv) Von Baer
- (v) Hydrolytic enzyme

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315. The diagram given below is that of a developing human foetus in the womb. Study the same and then answer the questions that follow :



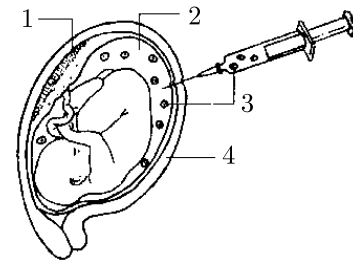
- Name the part labelled 1.
- Mention any two functions of the part labelled 2.
- Explain the role played by the part labelled 3.
- What is the normal gestation period (in days) of the developing embryo ?

Ans :

COMP 2009

- The part labelled '1' is Umbilical cord.
- Two functions of the part labelled '2' (placenta) are :
 - Allows diffusion of substances from mother to foetus and vice versa.
 - Act as an endocrine gland by producing estrogen and progesterone.
- The role played by part labelled '3' (Amniotic fluid) is to protect the embryo from physical damage by jerks or any kind of mechanical shocks and prevents sticking of foetus to the amnion.
- The normal gestation period (in days) of the developing foetus is 280 days.

316. The figure given below is a technique.



- Name the process.
- Name the fluid being taken out through the syringe.
- How is this process helpful ?
- How is it misused ?
- Label the parts 1 to 4.

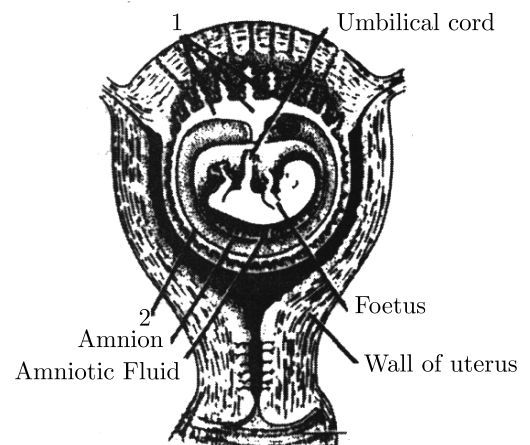
Ans :

COMP 2012

- Amniocentesis
- Amniotic fluid
- Helpful in prenatal diagnosis of sex of the foetus.
- It is misused by people knowing about the sex and if it is a female, they get it aborted since their desire is for a male child.
1. Placenta
2. Amniotic cavity
3. Foetal cells
4. Uterine wall.

317. Study the diagram given below and then answer the following questions :

- Label the parts 1 and 2
- State any one function of the amniotic fluid.
- What is the role of the umbilical cord in the development of the foetus ?



- Name the part in the diagram which is endocrine in nature.

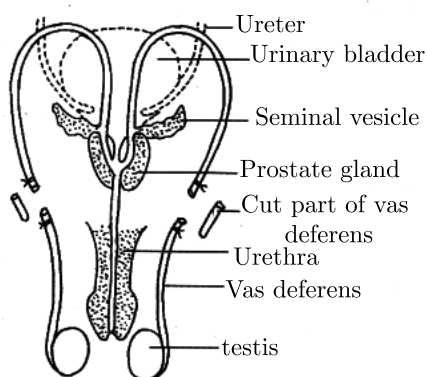
2.1 Natural Family Planning

By recognizing the rhythm of their menstrual cycles, women can calculate the time when the egg is produced by the ovary and can be fertilized by man's sperm. During this unsafe time (about 10 days in each month) the couple needs to abstain from sex. There are three ways of estimating the safe period calendar method, temperature method and mucus method.

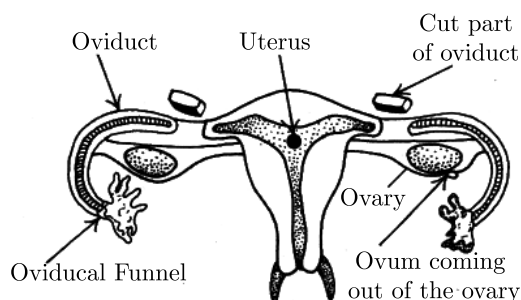
2.2 Artificial Family Planning

In recent times natural methods of contraception are replaced by this method since all the natural methods were unreliable. Artificial methods are :

1. Barrier contraception : Condom for males, diaphragm and spermicidal agents for females.
2. Intrauterine devices (IUDs) : Done in females.
3. Pills and injections : Combined and mini pills are taken orally by females. Progesterone injections are useful for females.
4. Sterilization : Vasectomy is done in males while tubectomy is done in females.
5. Medical termination of pregnancy : If a woman has somehow become pregnant and a couple does not want to have the child then the foetus can be removed by abortion. Three months pregnancy can be aborted by this method.



Vasectomy



Tubectomy

3. EVOLUTION

Evolution is the gradual change in the heritable characteristics of organisms from a simple to a more complex form. Natural selection is the principle by which each trait, if useful is preserved by natural.

MULTIPLE CHOICE QUESTION

1. **Assertion (A)** : All food chains begin with herbivores.

Reason (R) : Green plants are heterotrophs.

- (a) Assertion is True and Reason is False
- (b) Assertion is False and Reason is True
- (c) Both Assertion and Reason are True
- (d) Both Assertion and Reason are False

Ans :

SQP 2025

Thus (d) is correct option.

2. Birth rate is the number of live births per thousand persons in:

- (a) 1 year
- (b) 2 years
- (c) 10 years
- (d) 20 years

Ans :

MAIN 2024

The birth rate represents the number of live births per thousand individuals in a population over a specific period, usually one year.

Thus (a) is correct option.

3. Surgical method of sterilization in a woman involves cutting and tying of :

- (a) Ureter
- (b) Uterus
- (b) Urethra
- (d) Oviduct

Ans :

MAIN 2017

The surgical method of sterilization in women, called tubectomy, involves cutting and tying the oviducts (fallopian tubes). This blocks the passage of eggs, preventing fertilization and thus pregnancy.

Thus (d) is correct option.

4. Most of the cave paintings discovered are associated with

- (a) Homo erectus
- (b) Cro-Magnon man
- (c) Neanderthal man
- (d) Dryopithecus

Ans :

SQP 2010

CHAPTER 12

HUMAN POPULATION

SUMMARY

1. POPULATION

Group of organisms of the same species living in a geographically localized area and capable of interbreeding among themselves is termed as population. Literally, a population is a group of organisms of the same species occupying a particular space at a particular time. The population has a definite organization and structure and exhibits various characteristics.

Population throughout the world and in India has been rising at an alarming rate. Problem of rapidly growing population is the most serious and increasing challenge that mankind is facing today. The study of change in size and distribution of human population due to major fluctuations in environment is called population dynamics. The physiological capacity of individual to produce offspring's is called biotic potential.

1.1 Reasons for Rise in Human Population

Increased agricultural production and better public health and medical attention have increased the life expectancy. The sharply falling death rate is due to our success mainly on health front, supplemented by spread of education. These led to a tremendous increase in human population, reaching to an unmanageable extent.

1.2 Population Explosion

Sharp, prolific increase in population of human beings is called population explosion.

Factors responsible for population explosion in India :

Factors responsible for population explosion in India are as follows :

1. Illiteracy
2. Mortality rate
3. Traditional beliefs
4. Religious and social customs

5. Economic reasons
6. Desire for a male child
7. Lack of recreation
8. Better health care
9. Large scale immunization
10. Minimized food shortage

1.3 Higher Population Density – Consequences

Problems due to increased population density are:

1. Per capita income falls
2. Decrease of natural resources
3. Health goes down

Overall large population of a country is the result of having large families and the quality of life goes down.

1.4 Disadvantages of a Large Family

Disadvantage of large family is as follows :

1. Insufficient education
2. Insufficient medical care
3. Malnutrition
4. Poor housing
5. Poor health of mothers
6. Economic pressure
7. Poor clothing
8. Children neglected socially

2. POPULATION CONTROL

Population explosion is a severe threat to the country. The control of population can be achieved by reducing the birth rate. In order to reduce the birth rate people should be properly educated and should know about methods of family planning.

The ideal method of contraception (birth control) does not exist. For most people there is some inconvenience involved. Couples should consider the full range, as different methods are suitable for different phases of a man or woman's fertile life. Certain methods of contraception are suitable only for females after child birth.

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Ans :

COMP 2000

When environmental resistance is negligible and resources like food and space are abundant, a population grows rapidly without constraints, displaying a J-shaped growth curve. This curve represents exponential growth, where the population size increases rapidly over time without leveling off.

Thus (b) is correct option.

12. Population of World in 2012 was approximately

- (a) 4 million
- (b) 7 billion
- (c) 2 billion
- (d) 10 million

Ans :

MAIN 2005

In 2012, the approximate population of the world was around 7 billion. This milestone highlighted significant global population growth due to advancements in medicine, agriculture, and reduced mortality rates.

Thus (b) is correct option.

13. Birth rate is the number of lives birth

- (a) Per 100 people per decade
- (b) Per 1000 people per decade
- (c) Per 100 people per year
- (d) Per 1000 people per year

Ans :

SQP 2007

The birth rate is defined as the number of live births per 1000 people per year in a given population. It is a key demographic indicator used to measure population growth.

Thus (d) is correct option.

14. Australopithecus is also known as Southern ape, because it had

- (a) Ape-like characters
- (b) Man-like characters
- (c) Both (a) and (b)
- (d) Monkey-like characters

Ans :

COMP 2011

Australopithecus, known as the Southern ape, had a mix of both ape-like and man-like characters. While it had a small brain and some primitive features resembling apes, it also showed bipedalism and certain anatomical adaptations similar to early humans, marking it as an important ancestor in human evolution.

Thus (c) is correct option.

15. Darwin proposed the theory of origin of species by

- (a) Hybridisation
- (b) Mutation
- (c) Natural selection
- (d) Acquired characters

Ans :

SQP 2012

Charles Darwin proposed the theory of the origin of species by natural selection, which suggests that organisms better adapted to their environment tend to survive and reproduce, passing on advantageous traits to the next generation. This process gradually leads to the evolution of species over time.

Thus (c) is correct option.

16. According to Lamarck, well-developed auricle muscles of rabbit have evolved due to

- (a) Increasing need
- (b) Internal vital force
- (c) Continuous use
- (d) All of these

Ans :

COMP 2017

According to Lamarck's theory of inheritance of acquired characteristics, traits like the well-developed auricle muscles of rabbits evolved due to the increasing need for them, the influence of an internal vital force, and their continuous use. Lamarck believed that organisms could develop traits during their lifetime and pass them on to their offspring.

Thus (d) is correct option.

17. A contraceptive for men only

- (a) Condom
- (b) Diaphragm
- (c) Copper-T
- (d) Loop

Ans :

COMP 2020

A condom is a contraceptive device designed specifically for men. It is a barrier method used to prevent sperm from entering the female reproductive tract during sexual intercourse, helping to prevent pregnancy and reduce the risk of sexually transmitted infections (STIs). The other options, such as diaphragm, copper-T, and loop, are contraceptive devices for women.

Thus (a) is correct option.

18. Marriageable age for girls is

- (a) 18
- (b) 21
- (c) 20
- (d) 13

Thus (a) is correct option.

43. Scientists have studied various ancient species that could link humans and apes. Among them, one species is widely seen as the common ancestor, displaying traits found in both lineages. The common ancestor to both man and ape is
- Dryopithecus
 - Australopithecus
 - Sinanthropus
 - Homo erectus

Ans :

Dryopithecus is considered the common ancestor of humans and apes. It lived around 9 to 12 million years ago and had both ape-like and human-like traits, making it a key species in the evolutionary link between apes and humans.

Thus (a) is correct option.

DIRECTION : Matching Type Question

44. Priya studied the factors contributing to the rise in human population. She noted the following:

Factor	Effect on population growth
P	Reduced mortality and increased life expectancy.
Q	Desire for a male child leading to more births.

Identify the correct pair of factors:

- P – Better health care, Q – Traditional beliefs.
- P – Illiteracy, Q – Malnutrition.
- P – Mortality rate, Q – Economic pressure.
- P – Population control, Q – Per capita income

Ans :

MAIN 2012

Better health care reduces death rates and increases life expectancy, contributing to population growth. Traditional beliefs, including a desire for a male child, can result in more births. Thus (a) is the correct option.

45. Ravi was asked to identify consequences of population explosion. He listed the following:

Consequence	Impact on the population
P	Natural resources deplete rapidly.
Q	Health services become inadequate.

Identify the correct pair of consequences:

- P – Economic pressure, Q – Biotic potential.
- P – Decreased natural resources, Q – Poor health care.
- P – Malnutrition, Q – Economic prosperity.
- P – Per capita income rise, Q – Larger families.

Ans :

COMP 2010

Population explosion leads to the depletion of natural resources and strains the health care system, reducing its efficiency.

Thus (b) is the correct option.

Priya attempted to match population control methods with their corresponding category. She noted the following :

Method	Category
P	Natural family planning based on menstrual cycle..
Q	Contraceptive pills taken by females.

Identify the correct pair of methods:

- P – Calendar method, Q – Sterilization.
- P – Temperature method, Q – Progesterone injections.
- P – IUDs, Q – Condoms.
- P – Medical termination, Q – Barrier method.

Ans :

SQP 2015

The temperature method is part of natural family planning, while progesterone injections are a hormonal method of contraception used by females.

Thus (a) is the correct option.

47. Ravi studied the disadvantages of a large family. He noted the following :

Disadvantage	Impact on family members
P	Children may not receive adequate education..
Q	Economic resources are spread too thin.

Identify the correct pair of disadvantages:

- P – Poor health of mothers, Q – Economic pressure.
- P – Poor housing, Q – Lack of recreation.
- P – Insufficient education, Q – Economic pressure.
- P – Malnutrition, Q – Reduced natural resources.

Ans :

COMP 2010

for functions such as tool use, carrying objects, and complex manipulation. This was a significant evolutionary step in human development, enabling greater dexterity and cognitive advancements. Thus (d) is correct option.

- 25.** Robert Malthus in his Essay on Population stated that
- Population grows at arithmetic rate and the food at the geometric rate
 - Population grows at the same rate as the food
 - Population can grow indefinitely if enough food is provided
 - Population grows at geometric rate and the food at the arithmetic rate

Ans :

SQP 2010

Robert Malthus theorized that population growth could continue indefinitely as long as resources, especially food, were sufficient to support it. However, he warned that since resources like food typically grow at a slower rate, unchecked population growth could eventually lead to shortages, with natural limits curbing the population through famine, disease, or other factors.

Thus (c) is correct option.

- 26.** The theory of natural selection was proposed by
- Darwin
 - Lamarck
 - Wallace
 - Mendel

Ans :

COMP 2018

The theory of natural selection was proposed by Charles Darwin. This theory suggests that individuals with advantageous traits are more likely to survive and reproduce, passing those traits to future generations, leading to evolutionary changes over time. Alfred Wallace independently conceived a similar idea, but Darwin is most credited with the development and publication of the theory.

Thus (a) is correct option.

- 27.** Identify the pre-human ancestor
- Australopithecus
 - Ramapithecus
 - Neanderthal man
 - Cro-Magnon

Ans :

MAIN 2016

Ramapithecus is considered a pre-human ancestor and is one of the early primates thought to be

on the evolutionary path leading to humans. It predates other ancestors like Australopithecus, Neanderthals, and Cro-Magnon, which appeared much later in the evolutionary time line and are closer to modern humans.

Thus (b) is correct option.

- 28.** Vasectomy is cutting of
- Vas deferens
 - Fallopian tube
 - Seminal vesicle
 - Seminiferous tubule

Ans :

MAIN 2010

Vasectomy is a surgical procedure for male sterilization that involves cutting and sealing the vas deferens. This prevents sperm from mixing with semen and being released during ejaculation, effectively preventing fertilization.

Thus (a) is correct option.

- 29.** MTP is advised by the doctor upto the pregnancy of
- 15 weeks
 - 12 weeks
 - 20 weeks
 - 22 weeks

Ans :

COMP 2013

Doctors generally advise Medical Termination of Pregnancy (MTP) up to 12 weeks for routine cases due to lower medical risks. However, with special approval and under specific circumstances, MTP can be performed up to 20 weeks, particularly when health risks to the mother or fetal abnormalities are present.

Thus (b) is correct option.

- 30.** Ideal contraceptive should not be
- User-friendly
 - Effective
 - Easily available
 - Expensive

Ans :

SQP 2011

An ideal contraceptive should be user-friendly, effective, and easily available to ensure it can be widely and effectively used. Being expensive would limit accessibility and reduce its practicality as an ideal contraceptive option.

Thus (d) is correct option.

- 31.** Mortality refers to the
- Birth rate
 - Replacement rate
 - Fertility rate
 - Death rate

Ans :

COMP 2020

Raj correctly mentions the temperature method, while Sonu lists the calendar and mucus methods, which are all natural family planning methods. Thus (d) is the correct option.

- 53.** A teacher asked her students to identify two disadvantages of having a large family. Raj said: "Poor education and poor health." Sonu said: "Economic pressure and malnutrition." Lata said: "Better housing and higher per capita income." Abhay said: "Social neglect of children and economic prosperity." Who were correct?
- (a) Raj and Sonu
(b) Sonu and Abhay
(c) Lata and Abhay
(d) Raj and Lata

Ans :

SQP 2010

Raj correctly mentions poor education and health, while Sonu mentions economic pressure and malnutrition, all disadvantages of large families. Thus (a) is the correct option.

ONE MARK QUESTIONS

DIRECTION : Name the following :

- 54.** The surgical method of sterilization in the human female.

Ans :

COMP 2006

Tubectomy

- 55.** A statistical study of human population of a region.

Ans :

SQP 2001, 2003

Demography

- 56.** The number of persons per square kilometre at any one given time.

Ans :

MAIN 1995

Population Density.

- 57.** The statistical study of the human population of a region.

Ans :

COMP 2000

Demography.

- 58.** The number of individuals inhabiting per unit area.

Ans :

SQP 2016

Population density

- 59.** The popular sign for family planning in India.

Ans :

MAIN 2019

Inverted red triangle

- 60.** The minimum marriage age for girls in India.

Ans :

COMP 2020

Eighteen years

- 61.** Sterilization technique in males involving cutting and tying sperm duct.

Ans :

SQP 2021

Vasectomy

- 62.** The scientific study of human population.

Ans :

MAIN 2023

Demography

- 63.** Changes that occur in a population due to alternation in growth rate, sex ratio, etc.

Ans :

COMP 2000

Population dynamics

- 64.** The instrument used for cutting and tying the oviduct in females.

Ans :

MAIN 2001

Laproscopy

- 65.** The chemicals which kills sperms.

Ans :

SQP 2005

Spermicides.

- 66.** The statistical study of the human population of a region.

Ans :

COMP 2007

Demography

- 67.** Two renewable resources for the mankind.

Ans :

MAIN 2010

Forest and soil

- 68.** Two non-renewable resources for the mankind.

A high natality rate (birth rate) is a major cause of population explosion. When the birth rate exceeds the death rate, it leads to rapid population growth, especially when combined with advancements in healthcare and lower infant mortality rates.

Thus (a) is correct option.

- 38.** In female sterilization, a surgical method is used to prevent eggs from reaching the uterus, effectively providing permanent contraception. This procedure involves cutting and tying a specific reproductive structure. Surgical method of sterilisation in a woman involves cutting and tying of

- (a) Ureter
- (b) Uterus
- (c) Oviduct
- (d) Urethra

Ans :

SQP 2007

The surgical method of sterilization in women, known as tubal ligation, involves the cutting and tying of the oviducts (fallopian tubes). This prevents the egg from traveling from the ovaries to the uterus and blocks sperm from reaching the egg, thereby preventing fertilization.

Thus (c) is correct option.

- 39.** Copper-releasing IUDs prevent fertilization by releasing ions that affect specific reproductive activities, aiding in contraception. Copper releasing IUDs are used for suppressing the
- (a) Activity of ova
 - (b) Motility of the sperms
 - (c) Activity of the uterus
 - (d) Motility of ova

Ans :

SQP 2000

Copper-releasing IUDs (Intrauterine Devices) work primarily by releasing copper ions, which are toxic to sperm. This disrupts the motility of the sperms, preventing them from fertilizing the egg. Copper IUDs do not suppress the activity of ova or the uterus, but they create an environment that is hostile to sperm.

Thus (b) is correct option.

- 40.** Industrial melanism, observed during the industrial revolution, involved a specific organism developing darker coloration to better camouflage in polluted environments. The organism studied for Industrial melanism was a

- (a) Moth
- (b) Butterfly
- (c) Honey bee
- (d) Cockroach

Ans :

SQP 2019

The organism studied for industrial melanism was the peppered moth. During the Industrial Revolution in England, darker-colored moths became more common due to pollution darkening the trees, providing better camouflage against predators. This phenomenon was a key example of natural selection in action.

Thus (a) is correct option.

- 41.** Lamarckism, which suggests acquired traits are inherited, struggles to explain certain natural phenomena where traits aren't influenced by acquired characteristics. Lamarckism fails to explain which of the following phenomenon?
- (a) An intellectual person having a dull son
 - (b) Absence of all the four limbs amongst amphibians
 - (c) Exceptionally long neck of giraffe
 - (d) Loss of vision in caved-welling mammals

Ans :

MAIN 2009

Lamarckism suggests that acquired traits are passed to offspring, which would imply that intellectual abilities (an acquired characteristic) should be inherited. However, intellectual ability is not directly inherited, making this example a limitation of Lamarck's theory, as it does not account for genetic inheritance independent of acquired traits.

Thus (a) is correct option.

- 42.** August Weissman experiment involved cutting tails of mice over generations, yet their offspring still had normal tails, disproving Lamarck's theory of acquired inheritance. Concept of inheritance of acquired characters was disapproved by the experiments of

- (a) Weismann
- (b) Oparin
- (c) Fox
- (d) Darwin

Ans :

COMP 2019

The concept of inheritance of acquired characters was disapproved by Weismann through experiments on mice, where he cut off their tails for several generations. The offspring still had tails, showing acquired traits aren't inherited. This rejected Lamarck's theory and supported genetic inheritance.

Ans :

MAIN 2001

The legal marriageable age for girls in India is 18 years. This law is designed to prevent child marriages and ensure that girls have the opportunity to complete their education and mature physically and emotionally before marriage.

Thus (d) is correct option.

19. Human population growth curve resembles a

- (a) S-shaped curve
- (b) J-shaped curve
- (c) Zigzag curve
- (d) None of the above

Ans :

COMP 2005

The human population growth curve generally resembles an S-shaped curve (also known as a sigmoid curve). Initially, the population grows slowly, followed by a period of rapid growth, and eventually levels off as it approaches the carrying capacity of the environment due to limiting factors like resources and space.

Thus (b) is correct option.

20. Darwin in his 'natural selection theory' did not believe in any role of which one of the following in organic evolution?

- (a) Discontinuous variations
- (b) Parasites and predators as natural enemies
- (c) Survival of the fittest
- (d) Struggle for existence

Ans :

COMP 2010

In Darwin's theory of natural selection, he primarily focused on continuous variations as the basis for evolution, where small, gradual changes accumulate over time. He did not give much importance to discontinuous variations, which are large, sudden changes (now associated with mutations). Darwin emphasized factors like the struggle for existence, survival of the fittest, and the role of parasites and predators in shaping natural selection.

Thus (a) is correct option.

21. The species of human being who lived around 2 mya.

- (a) Homo sapiens
- (b) Cro-Magnon
- (c) Neanderthals
- (d) Homo erectus

Ans :

SQP 2015

Homo erectus lived around 2 million years ago (mya). This species is considered one of the earliest human ancestors that exhibited significant advancements, including the use of tools and fire. Homo sapiens, Cro-Magnon, and Neanderthals appeared much later in human evolution.

Thus (a) is correct option.

22. In the evolution of man, Homo erectus is considered to be evolved from

- (a) Dryopithecus
- (b) Ramapithecus
- (c) Cro-Magnon
- (d) Australopithecus

Ans :

MAIN 2017

In human evolution, Homo erectus is believed to have evolved from Australopithecus, which exhibited both ape-like and human-like characteristics, including bipedalism. Australopithecus represents an important transitional species leading to more advanced humans like Homo erectus, who had larger brain capacity and more refined tool usage.

Thus (d) is correct option.

23. What was directly responsible for the rapid rise of world population in the twentieth century?

- (a) Use of antibiotics and prophylactic vaccinations
- (b) Increased food production
- (c) Better transport facilities
- (d) Better education and job prospects

Ans :

MAIN 2016

The use of antibiotics and prophylactic vaccinations in the 20th century significantly reduced death rates by controlling infectious diseases, which was directly responsible for the rapid rise in the world population. This, along with advancements in medical care, led to longer life expectancies and a population boom.

Thus (a) is correct option.

24. The major advantage of bipedal locomotion is that it

- (a) Increases speed
- (b) Reduces body weight
- (c) Provides better body support
- (d) Releases the forelimbs for other better functions

Ans :

COMP 2015

The major advantage of bipedal locomotion is that it releases the forelimbs, allowing them to be used

In large families, children may not receive proper education due to financial constraints, and economic pressure makes it difficult to provide for everyone adequately.

Thus (c) is the correct option.

48. Priya tried to categorize family planning methods. She listed the following:

Method	Type
P	Children may not receive adequate education..
Q	Economic resources are spread too thin.

Identify the correct pair of methods:

- (a) P – Condoms, Q – Tubectomy.
- (b) P – Diaphragm, Q – Vasectomy.
- (c) P – IUDs, Q – Calendar method.
- (d) P – Injections, Q – Barrier method.

Ans :

MAIN 2017

A diaphragm is a barrier method that prevents sperm from entering the uterus, while vasectomy is a surgical method that cuts or blocks the sperm ducts to prevent sperm release.

Thus (b) is the correct option.

DIRECTION : Conversation Type Question

49. A teacher asked her students to list two consequences of population explosion.

Raj said: "Depletion of natural resources and lower health standards."

Sonu said: "Increased education and economic prosperity."

Lata said: "Per capita income decreases and health issues rise."

Abhay said: "Increased food production and better housing."

Who were correct?

- (a) Raj and Lata
- (b) Sonu and Abhay
- (c) Lata and Abhay
- (d) Raj and Sonu

Ans :

COMP 2018

Raj correctly mentions the depletion of resources and lower health standards, while Lata mentions the decrease in per capita income and health issues, both consequences of population explosion. Thus (a) is the correct option.

50. A teacher asked her students to provide two examples of factors leading to population explosion in India.

Raj said: "Illiteracy and better health care."

Sonu said: "Increased mortality and improved nutrition."

Lata said: "Desire for a male child and economic reasons."

Abhay said: "Large-scale immunization and minimized food shortage."

Who were correct?

- (a) Raj and Lata
- (b) Sonu and Abhay
- (c) Lata and Abhay
- (d) Raj and Sonu

Ans :

SQP 2019

Lata correctly lists desire for a male child and economic reasons, while Abhay lists immunization and reduced food shortages, all contributing to population growth in India.

Thus (c) is the correct option.

51. A teacher asked her students to list two methods of artificial family planning.

Raj said: "Condoms and calendar method."

Sonu said: "Pills and vasectomy."

Lata said: "Medical termination and temperature method."

Abhay said: "Diaphragm and IUDs."

Who were correct?

- (a) Raj and Sonu.
- (b) Sonu and Abhay.
- (c) Lata and Abhay.
- (d) Sonu and Lata.

Ans :

MAIN 2021

Sonu and Abhay both correctly listed artificial methods. Sonu mentioned pills and vasectomy, and Abhay mentioned diaphragm and IUDs, all of which are valid artificial methods.

Thus (b) is the correct option.

52. A teacher asked her students to name two natural family planning methods.

Raj said: "Temperature method and diaphragm."

Sonu said: "Calendar method and mucus method."

Lata said: "Sterilization and calendar method."

Abhay said: "Vasectomy and mucus method."

Who were correct?

- (a) Raj and Abhay.
- (b) Sonu and Lata.
- (c) Sonu and Abhay.
- (d) Raj and Sonu.

	Natality		Mortality
(a)	It is the number of live births per 1000 people of the population per year.	(a)	It is the number of deaths per 1000 people of the population per year.

85. Demography and Population density [Definition]

Ans : MAIN 2017

Demography : Branch of science dealing with statistical study per unit of human population area at a given time.

Population density : Number of individuals of a species

DIRECTION : Answer the following :

86. Mention two reasons for increase in population in India.

Ans : SQP 2004

- (i) Illiteracy.
- (ii) Economic reasons.

87. What are the age restrictions for marriage by law for boys and girls in India ?

Ans : MAIN 2003

21 years for boys and 18 years for girls.

88. Name two surgical techniques that can be used to prevent pregnancy.

Ans : COMP 2003

Vasectomy for males and Tubectomy for females.

89. Give three advantages of a small family.

Ans : MAIN 2010

Advantage of small family :

- (i) Adequate and balanced diet can be provided to each member of the family.
- (ii) Proper medical aids can be provided.
- (iii) Each member can be given education of higher standard.

90. The birth rate in India is very high.

Ans : SQP 2019

Due to better medical care there is a fall in death rate both for infants and the old. As long as birth rate exceeds death rate population grows rapidly.

91. Define Birth rate.

Ans : COMP 2003

It is defined as the number of births per thousand people of a given population per year.

92. Define Death rate.

Ans : SQP 1996

It is the number of deaths per 1000 of population per year in a particular area.

93. What are the age restrictions for marriage for boys and girls in India ?

Ans : MAIN 2009

The age restrictions for marriage for boys is 21 years and of girls is 18 years.

94. What is the sign of family welfare ?

Ans : COMP 2010

Inverted red triangle.

95. What factors govern the growth of a population ?

Ans : SQP 2015

Birth rate, death rate, emigration and immigration.

96. What are spermicides ?

Ans : MAIN 2017

These are certain chemical agents that kill the sperms.

97. What is census ?

Ans : SQP 2019

It is the counting of existing population at a fixed time as regards name, age, sex, occupation, date of birth, matrimonial status, race, religion and education.

98. What are the problems posed by increased population in India ?

Ans : COMP 2022

Food shortage, housing problem, poor health and poor standard of living.

99. What are the causes of increased population in India?

Ans : SQP 2023

Early marriage, increase in birth rate, lack of knowledge about family planning, advancement in medical sciences and improved life expectancy.

Ans : COMP 2015
Minerals and petroleum

- 69.** A surgical method of fertility control (sterilization) in males.

Ans : SQP 2016
Vasectomy

- 70.** A surgical method of fertility control (sterilization) in females.

Ans : COMP 2019
Tubectomy

- 71.** The technical term used for the difference between the birth rate and the death rate in a population.

Ans : MAIN 2015
Growth rate

- 72.** The number of males and females in a population
Population and its Control

Ans : SQP 2016
Sex ratio

- 73.** The surgical method of fertility control in females.

Ans : COMP 2019
Tubectomy

- 74.** The numerical difference between birth rate and death rate.

Ans : MAIN 2000
Growth rate

- 75.** Give an example of IUD.

Ans : SQP 2005
Copper-T

- 76.** A non-conventional source of energy.

Ans : COMP 2007
Wind energy

DIRECTION : Rewrite the wrong statement by inserting a word/ words.

- 77.** Death rate is the number of deaths of a given population per year.

Ans : SQP 2004
Death rate is the number of deaths per 1000 people of a given population per year.

- 78.** Tubectomy is the surgical method of sterilisation in males.

Ans : MAIN 2010
False, Vasectomy is the surgical method of sterilisation in males.

DIRECTION : Give appropriate biological or technical term for the following :

- 79.** The difference between the birth rate and the death rate.

Ans : COMP 2018
Growth rate of population

- 80.** The method of contraception in which the sperm duct is cut and ligated.

Ans : SQP 2014
Vasectomy

DIRECTION : Give biological explanations for the following :

- 81.** Education is very important for population control.

Ans : MAIN 2018
Helps people know about family planning and consequences of having large families.

DIRECTION : Explain the following term :

- 82.** Natality

Ans : SQP 2017
It refers to the number of live births produced per thousand people of the population per year. It is also called as birth rate.

- 83.** Population Density

Ans : MAIN 2010
It is defined as the number of individuals of a species per unit area.

DIRECTION : Distinguish between:

- 84.** Birth rate (natality) and death rate (mortality)

Ans : SQP 2012

Ans :

COMP 2014

Mortality refers to the death rate in a population. It measures the number of deaths per unit of population within a specific time period, often used to assess the health and longevity of a population.

Thus (d) is correct option.

- 32.** The first scientist who proposed his theory for the evolution was

- (a) Darwin
- (b) Mendel
- (c) Wallace
- (d) Lamarck

Ans :

SQP 2011

Jean-Baptiste Lamarck was the first scientist to propose a theory of evolution. His theory, known as Lamarckism, suggested that organisms evolve through the inheritance of acquired characteristics. Although later largely discredited, Lamarck's ideas laid the groundwork for future evolutionary theories, including Darwin's theory of natural selection.

Thus (d) is correct option.

- 33.** Darwin's theory of evolution fails to explain the
- (a) Role of environment
 - (b) Overproduction
 - (c) Origin and transmission of variations
 - (d) Survival of the fittest

Ans :

MAIN 2015

Darwin's theory of evolution explains natural selection, survival of the fittest, and the influence of the environment, but it does not explain the origin and transmission of variations. The mechanism behind genetic variations was not understood until the discovery of genetics by Mendel, which provided insights into how traits are inherited.

Thus (c) is correct option.

DIRECTION : Case Based Questions

- 34.** Lamarck's theory suggests that organisms can pass traits acquired during their lifetime to their offspring, proposing a unique view on evolution compared to natural selection. Lamarck's theory of evolution is also called as
- (a) Theory of natural selection
 - (b) Survival of the fittest
 - (c) Theory of special creation
 - (d) Inheritance of acquired characters

Ans :

SQP 2018

Lamarck's theory of evolution is known as the theory of inheritance of acquired characters. He proposed that organisms could pass on traits they acquired during their lifetime to their offspring, which would lead to evolutionary changes over generations. This theory is distinct from Darwin's natural selection.

Thus (d) is correct option.

- 35.** Human population is estimated to be 7.2 billion by

- (a) 2000
- (b) 2005
- (c) 2015
- (d) 2010

Ans :

COMP 2019

The human population was estimated to reach around 7.2 billion by the year 2015. This milestone was achieved due to factors like improved healthcare, decreased mortality rates, and high birth rates in many parts of the world.

Thus (c) is correct option.

- 36.** In the study of human evolution, certain ancestors are known for specific traits or skills. One ancestor, often called the "handy man," was notable for using tools, marking a significant step in human development. The human ancestor who was called as handy man.

- (a) Neanderthals
- (b) Homo erectus
- (c) Cro-Magnon
- (d) Homo-Habilis

Ans :

SQP 2019

Homo habilis is often referred to as the "handy man" because it was one of the earliest human ancestors known to use tools. The discovery of simple stone tools alongside Homo habilis fossils indicates their ability to create and use tools, marking an important step in human evolution.

Thus (b) is correct option.

- 37.** Population explosion often results from a high birth rate surpassing death rates, causing rapid growth. Identifying the main cause helps in understanding population trends. Identify the major cause of population explosion from those given below

- (a) High natality rate
- (b) Literacy
- (c) Low natality rate
- (d) None of these

Ans :

SQP 2019

- 100.** State some of the common methods of birth control practiced in India.

Ans : MAIN 2011

Oral pills, condoms, ND, Diaphragm, Spermicides, rhythm method.

- 101.** When is the world population day celebrated?

Ans : SQP 2015

World population day is celebrated on 11th July.

- 102.** What is the sign of family welfare in our country?

Ans : COMP 2017

The sign of family welfare in our country is an 'Inverted Red Triangle'.

- 103.** What is population explosion?

Ans : SQP 2016

Rapid increase in population over a certain period of time is called population explosion.

- 104.** Name the resources which can be replenished by reproduction or recycling.

Ans : MAIN 2018

Renewable resources.

- 105.** How does condom prevent fertilization?

Ans : COMP 2012

It stops meeting of sperm and egg and prevents fertilization to take place.

- 106.** What is the present population of India and its ranking in the world?

Ans : SQP 2011

India has the second largest population in the world with a population of 1.21 billion.

- 107.** When is world population day observed and what is its aim?

Ans : COMP 2015

It is celebrated on July 11 and seeks to raise awareness of global population issues.

- 108.** Which countries have shown reduced population growth in a matter of 15 years?

Ans : SQP 2017

Germany, Italy, Japan and Russia.

- 109.** Choose the correct alternative :

- (i) Human population growth curve resembles (J shaped curve, zig zag curve, parabola curve, S shaped curve).
- (ii) The carrying capacity of a population is determined by its (limiting sources, natality, mortality, population growth curve).
- (iii) Which of the following means of birth control is most effective in preventing AIDS ? (Condom, Pill, diaphragm, spermicidal jelly).
- (iv) The rate at which a population grows or declines depend upon the rate of (births, immigration, deaths, all of these).
- (v) Minimum age of marriage for boys is 21 years and for girls is (17, 18, 19, 20) years.

Ans : MAIN 2019

- (i) J shaped curve
- (ii) Limiting resources
- (iii) Condom
- (iv) All of these
- (v) 18

- 110.** Match the items given in column I with those of column II :

	Column I		Column II
1.	Tubectomy	(a)	Population dynamics
2.	Demography	(b)	Termination of pregnancy
3.	Abortion	(c)	Prevents ovulation
4.	Birth rate	(d)	Sterilization in females
5.	Contraceptives	(e)	Natality

Ans :

1. – (d); 2. – (a); 3. – (b); 4. – (e); 5. – (c)

- 111.** Explain the following :

- (i) Age ratio
- (ii) Natality rate
- (iii) Physical enumeration

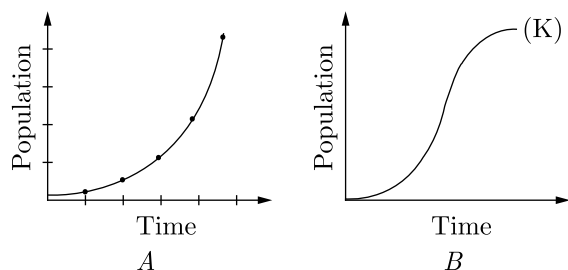
Ans :

SQP 2020

- (i) The number of individuals belonging to different age groups is called age ratio.
- (ii) The number of offspring produced per unit time per unit of population is termed natality.
- (iii) Physical enumeration is the estimation of human population by physical counting of the individuals per unit area. The Census Bureau physically verifies the number of persons living in each house.

Part - 4 – It protects and provides nutrients etc. to the foetus.

185. (i) What is population growth curve?



- (ii) What do the two growth curves in A and B represent?
 (iii) Explain the term carrying capacity.
 (iv) Briefly explain S and J growth curve.

Ans :

COMP 2015

- (i) It is plotting graphically, a growth curve of population size against the timeline.
 (ii) A – J shaped growth curve.
 B – S shaped growth curve (sigmoid curve)
 (iii) Carrying capacity: The maximum limit of an ecosystem that can provide basic needs to a population under certain conditions.
 (iv) S growth curve: The growth curve at first shows slow growth of population and then fast growth but finally the growth rate slows down due to several environmental factors.
 J growth curve: Sudden exponentially increase in the population of species due to good environmental conditions (in terms of food, water and natural habitat) or a sudden drastic decline of species population due to adverse conditions.

CASE BASED QUESTION

186. In a densely populated country, the government is trying to understand the factors responsible for the rapid increase in population. They are analyzing various factors contributing to population growth.
- What is the term used to describe a sharp, prolific increase in the population of human beings?
 - Identify two primary reasons for the rise in the global human population.
 - How does population density affect natural resources and health?

- What is the relationship between biotic potential and population size?

Ans :

- Population explosion.
- Better health care and increased agricultural production.
- It depletes resources and worsens health conditions.
- Biotic potential increases population size if conditions allow.

187. A rural region in India is facing a population explosion due to traditional beliefs and the desire for large families. The government is conducting a study to identify key factors contributing to this issue.

- List three factors responsible for population explosion in India.
- How does illiteracy contribute to population growth?
- Why does the desire for a male child increase population growth in some regions?
- What role do better health care and immunization play in population growth?

Ans :

- Illiteracy, traditional beliefs, and desire for a male child.
- Illiteracy limits awareness of family planning methods.
- Families may keep having children until a male is born.
- They reduce mortality and increase life expectancy.

188. A couple in a developing country is seeking advice on family planning. They are considering both natural and artificial methods of contraception to control the number of children they have.

- What is natural family planning, and how does it help control population?
- Name two artificial methods of contraception suitable for males and females.
- Why might some people prefer artificial methods of contraception over natural methods?
- What is vasectomy, and how does it contribute to population control?

Ans :

- Avoiding sex during unsafe periods prevents pregnancy.
- Condoms for males and IUDs for females.

130. Deforestation leads to _____.

Ans : MAIN 2022

Drought

131. Usage of condom is a type of _____ method.

Ans : SQP 2023

Barrier

132. Population increases in _____ ratio.

Ans : COMP 2020

Geometrical

DIRECTION : State whether the following are true or false. If false, rewrite the correct statement.

133. Mortality is the number of deaths per thousand of the population per decade.

Ans : SQP 2021

False. Mortality is the number of deaths per thousand of the population per year.

134. Diaphragm is a contraceptive for females.

Ans : MAIN 2021

True.

135. Tidal energy is a non-conventional source of energy.

Ans : COMP 2000

True.

136. Fossil fuels are inexhaustible resources.

Ans : MAIN 2005

False. Fossil fuels are exhaustible resources.

137. Mortality is the number of deaths per thousand of the population per decade.

Ans : COMP 2010

False. Mortality is the number of deaths per thousand of the population per year.

138. Tubectomy is the surgical method of sterilisation in males.

Ans : SQP 2012

False. Vasectomy is the surgical method of sterilisation in males.

139. Afforestation leads to drought.

Ans : MAIN 2013

False. Deforestation leads to drought.

140. Fossil fuels are exhaustible.

Ans : SQP 2017

True

141. Tidal energy is an example of non-conventional source of energy.

Ans : COMP 2019

True

DIRECTION : Explain the terms:

142. Population dens

Ans : MAIN 2000

The total number of individuals per square kilometre in an area at a time.

143. Natality

Ans : COMP 2001

It is the number of live births per 1000 people of the population per year.

144. Death rate

Ans : SQP 2006

Death rate is the number of deaths per thousand of the population per year.

DIRECTION : Give the scientific term for the following:

145. The surgical method of sterilisation in the human female.

Ans : COMP 2010

Tubectomy

146. The number of live births per thousand people of the population per year.

Ans : SQP 2015

Natality

147. The number of people per square kilometre at any given time.

Ans : MAIN 2016

Population density.

DIRECTION : Give the full form of the following and explain its meaning :

148. IUD

Ans :

COMP 2019

IUD stands for Intra uterine device. It helps to check pregnancy. It is a small device which is inserted into the uterus and hence no pregnancy.

149. MTP

Ans :

SQP 2000

MTP stands for medical termination of pregnancy. It is method where the foetus is destroyed after pregnancy has occurred.

150. Population density and Population explosion

Ans :

SQP 2017

	Population Density		Population Explosion
(a)	It is the total number of individuals in a given geographic region at a time.	(a)	It is the phenomenon of rapid increase of population.

151. Immigration and Emigration

Ans :

MAIN 2019

	Immigration		Emigration
(a)	It is the addition of individuals to a population who comes to live from outside the country.	(a)	It is the decrease in a population due to individuals moving out of the country.

152. ZPG

Ans :

COMP 2006

ZPG stands for zero population growth. In this case the birth rate equals the death rate. Hence no growth in population takes place.

DIRECTION : With reference to population control what is meant by the following terms :

153. Laparoscopy

Ans :

SQP 2009

It is a process of tying of oviducts in females and sperm duct in males to block them with the help of an instrument called laparoscopy.

154. Spermicides

Ans :

MAIN 2010

These are chemicals which kills sperms which are generally available in the form of creams and jellies

155. Contraceptive

Ans :

COMP 2015

These are methods of preventing pregnancy in women. It includes devices for both males and females.

DIRECTION : Distinguish between the following :

156. Differentiate between Population density and population explosion.

Ans :

COMP 2020

Population density is the total number of individuals in a given geographic region at a time while population explosion is the phenomenon of rapid increase of population.

DIRECTION : Define:

157. Population

Ans :

SQP 2023

All the members of a given species occupying a given area form a population.

158. Demography

Ans :

MAIN 2011

Demography It is the statistical study of human population with reference to size, density, etc.

159. Growth rate

Ans :

SQP 2017

Growth rate It is the difference between birth rate and death rate of a population.

160. Population growth

Ans :

MAIN 2011

Population growth It is the rate of increase or decrease in the number of individuals of the population in a specific period.

TWO MARKS QUESTIONS

- 161.** "Birth rate in India is very high." Mention Two reasons in support of the statement.

Ans :

MAIN 2024

Illiteracy, children are a gift of God, sign of prosperity, due to high infant mortality, more helping hands for family income, do not accept family planning methods, desire for a male child, lack of recreation

- 162.** The need to limit the size of the family is more vital today than ever before. Give two reasons.

Ans :

COMP 1993, 1992, 1997

Due to growth in population every year, the country has to spend more on food, clothing and housing. A larger population produces more wastes causing pollution and upsetting the ecological balance.

- 163.** Why resources cannot keep pace with the rising population? Give two examples.

Ans :

SQP 1996

- (i) Population grows by geometric progression while food production increases by arithmetic progression.
- (ii) Indiscriminate cutting of trees to make land available for cultivation is one of the serious consequences of overpopulation.

- 164.** Write any two major reasons for the population explosion in the world.

Ans :

MAIN 2012, 2013

Better healthcare at all age group/Fewer deaths due to better medical aids/Minimized food shortage/Balanced and improved nutrition/Large scale immunization.

- 165.** State two reasons for the increase of population in India.

Ans :

SQP 2015

The increase of population in India is due to the following reasons :

Illiteracy/desire for a male child/children are a gift of God/lack of recreation/poor family income/universality of marriage/child marriages/lack of family planning/mortality rate among low income group.

- 166.** Give biological reasons for the following statement : Cutting of trees should be discouraged.

Ans :

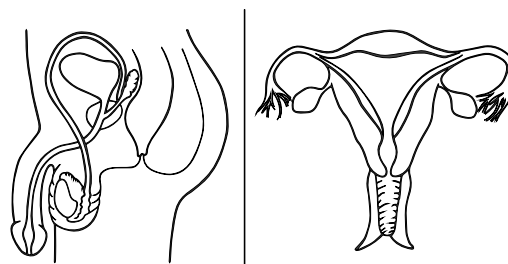
COMP 2017

Cutting of tree should be discouraged because it would lead to less utilization of CO_2 in photosynthesis due to which rise in CO_2 will lead to greater retention of solar radiation in the atmosphere causing global warming.

- 167.** Draw the female and male reproductive system showing tubectomy and vasectomy.

Ans :

SQP 2015



- 168.** Define sustainable development.

Ans :

MAIN 2015

Sustainable resources refers to using resources in such a way that it can be used in the future. It must be used to check the over exploitation of resources. This means that development must be done without disturbing the developments of the future generation.

- 169.** Vasectomy

Ans :

SQP 2018

Vasectomy: It is the cutting and ligating the vas deferens in males.

- 170.** What are the advantages of IUD ?

Ans :

COMP 2017

- (i) IUD is easy to use and very effective.
- (ii) IUD is very effective in birth control.
- (iii) It is mainly suitable for those who want to practise small family norms after having one or two children.

- 171.** What are the disadvantages of IUD ?

Ans :

MAIN 2019

- (i) IUD can be expelled from the body.
- (ii) It requires replacement every year.
- (iii) It may cause infection leading to sterility.

DIRECTION : Choose the correct option from the brackets:

- 112.** Death rate is the number of death
[Per hundred people per year, per thousand people per year, per hundred people per decade, per thousand people per decade]

Ans : COMP 2011

Per thousand people per year.

- 113.** Vasectomy is cutting of
[Fallopian tube, vas deferens, seminal vesicle, seminiferous tubule]

Ans : SQP 2013

Vas deferens.

- 114.** Marriageable age for girls is
[18, 21, 13, 20]

Ans : MAIN 2015

18.

- 115.** A contraceptive for men only
[Diaphragm, condom, copper-T, loop]

Ans : SQP 2017

Condom.

- 116.** The statistical study of human population.
[Demography, population density, population, growth rate]

Ans : COMP 2018

Demography

- 117.** The marriageable age for boys
[18, 21, 20, 25]

Ans : SQP 2016

21

- 118.** Intra uterine devices prevent
[Fertilization, implantation, meeting of sperm and ovum, release of ovum]

Ans : MAIN 2000

Implantation

DIRECTION : Complete the following:

- 119.** Birth rate is the number of _____ births per thousand of the population per year.

Ans : SQP 2011

Live births

- 120.** Pregnancy can be avoided by using _____.

Ans : MAIN 2013

Contraceptive pills

- 121.** The addition of new individuals to the population from other localities is called _____.

Ans : MAIN 2013

Immigration

- 122.** Family planning's popular sign is _____ triangle.

Ans : COMP 2014

Inverted red

- 123.** Population increases in _____ ratio while food production increases in _____ ratio.

Ans : SQP 2013

Geometric; arithmetic

- 124.** Non-conventional energy includes _____.

Ans : COMP 2019

Tidal energy

- 125.** Population increases in geometric ratio while food increase in _____ ratio.

Ans : SQP 2011

Arithmetic

- 126.** _____ is misused for sex tests.

Ans : COMP 2015

Amniocentesis

- 127.** The addition of new individuals to the population from other localities is called _____.

Ans : SQP 2019

Immigration

- 128.** As per the UN report the world population will reach _____ billion by the year 2020.

Ans : COMP 2020

7.5

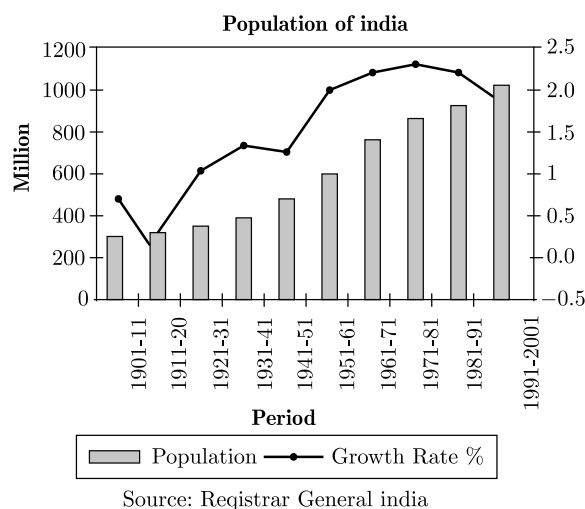
- 129.** _____ is the technical term used for the difference between the birth rate and death rate.

Ans : SQP 2021

Growth rate

economical income. However, gases emitted by these industries causes pollution and building of industrial areas also are one of the cause of deforestation. Roads, dams, agricultural lands requirement, increases with the growing demand of population and that adversely affects the environment ultimately. Sustainable development is a way to use and keep both environment and resources eco-friendly

183. (i) From the graphs A and B given below, what do you understand about India's population and birth and death rate?
- (ii) Industrial, scientific and agricultural revolutions are the reasons for rapid rise in population. Explain briefly.



Ans :

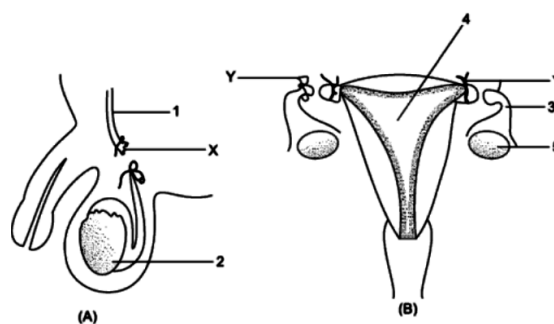
MAIN 2012

- (i) From figure A, it is obvious that the population is on the rise since 1911-20 and has reached 1 billion by 1991-2001. However, the growth rate % shows a dip in 1911-20, 1941-51 and 1991-2001.
- (ii) From figure B, the birth rate since 1901-11 to 1991-2001 has shown a steady decline over the years. The death rate between 1901-11 and 1911-20 has shown a sudden rise, after which it has shown steady decline rate and between 1971-81, 1981-91, 1991-2001, the death rate seems almost constant from then onwards. Therefore, the revolutions and awareness brought in rise in population.

FIVE MARKS QUESTIONS

184. Observe the diagram A and B given below :

- (i) Label the parts 1 - 5.



- (ii) What does diagram A depict ?
- (iii) What does diagram B depict ?
- (iv) Comment on X and Y.
- (v) State one function each of part 2 and 4.

Ans :

MAIN 2010

- (i) 1-Vas deferens; 2-Testes; 3-Oviduct; 4-Uterus; 5-Ovary.
- (ii) Diagram A depicts Vasectomy (cutting and tying of the vas deferens).
- (iii) Diagram B depicts Tubectomy (cutting and tying of the oviduct).
- (iv) 'X' represents cut and tied end of vas deferens which prevents the entry of sperms and prevents pregnancy.
'Y' represents the cut and tied end of oviduct. It prevents the entry of ovum into the duct and thus prevents pregnancy.
- (v) Part - 2 - To produce sperms and male sex hormones.

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CHAPTER 13

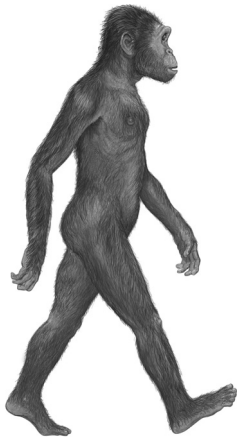
HUMAN EVOLUTION

1. HUMAN EVOLUTION

Human evolution: is about the origin of human beings. Their birth place was in Africa but spread to almost all parts of the world.

1.1 Human Ancestors

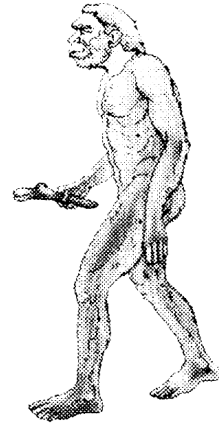
- (i) **Australopithecus** – are the immediate ancestors of modern human being. They were evolved in eastern Africa around four million years ago.



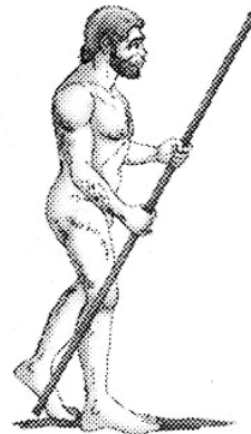
They had a flat nose, a strongly projecting lower jaw and brain case (cranium) was about 1/3 the size of modern human brain. Their brain size was usually less than 500cc. Their canine teeth were reduced in size compared to those of apes. The position of foramen magnum showed evidence of bipedal locomotion.

- (ii) **Homo habilis** : They were the species of the tribe Hominine lived in Eastern and Southern Africa around 2.4 to 1.4 mya. They were called handy man or skillful person. They developed from Australopithecus. They show definite obligate bipedalism. They had protruding jaws with large molars, no chin, thick brow ridges and low skull. The brain size was between 650 and 1300cc. They were smaller than modern man. The cranial capacity slightly more than 500cc. The cranial base was narrow and elongated.

NODIA



- (iii) **Homo erectus** : They originated in Africa and distributed from there to other parts of the world. They were the first hominine species that had bipedal locomotion indistinguishable from that of Homo sapiens. They had an average cranial capacity of about 50 to 1100 cc. Their brain size exceeded modern man. Their canine teeth were larger than modern man. They had a moderately taller posture.



- (iv) **Neanderthals** : They were largely related to human. They were evolved between 500000 and 600000 mya. They lived in Europe and South west Asia. They showed bipedalism and walked upright. They had a cranial capacity of 1300-1600cc, i.e. larger than modern man. They had large brains, angled cheek bones,

3. Artificial methods are more reliable than natural methods.
4. Vasectomy prevents sperm release, reducing fertility.

189. A family with five children is facing several issues related to their large size, including economic pressure and poor health. They are struggling to provide adequate education, nutrition, and housing for their children.

1. What are two disadvantages of having a large family?
2. How does a large family lead to malnutrition?
3. What impact does a large family have on the education and social development of children?
4. How does economic pressure affect the overall quality of life in a large family?

Ans :

1. Poor education and health for children.
2. Resources like food may be insufficient.
3. Children may be neglected in education and social development.
4. Economic pressure leads to poor housing and living conditions.

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172. What is induced abortion?

Ans : SQP 2021

If there is any genetic disorder in the embryo, it can be terminated by a trained doctor in a hospital. This is known as induced abortion or medical termination of pregnancy.

173. Rapid rise of population demands the use of non-conventional use of energy. Comment.

Ans : SQP 2023

Due to population explosion, fossil fuels such as coal and petroleum are depleting fast. These are non-renewable sources of energy and also cause pollution. So, man must shift to the usage of non-conventional sources of energy such as solar energy, tidal energy, nuclear energy, biogas etc. and their uses must be popularised.

174. What factors govern the growth of population?

Ans : MAIN 2011

- (i) Birth rate
- (ii) Death rate
- (iii) Emigration and Immigration

175. List three factors that have contributed to an increase in human population.

Ans : SQP 2015

- (i) Advancement in the medical science to check the diseases.
- (ii) Mechanized agriculture for more food production.
- (iii) Industrialization.

176. What is census?

Ans : COMP 2017

It is the counting of existing population every 10 years at a fixed time as regards to name, age, sex, occupation, date of birth, matrimonial status, race, religion, education, etc.

177. The need to limit the size of the family is more vital today than ever. Give two reasons.

Ans : MAIN 2019

Small family is a happy family. If population increases at an alarming rate it may create many consequences to the families and the society like health problems, lack of education, poor sanitation, lowering of standard of living, etc.

178. What are IUCD's?

Ans :

COMP 2017

These are contraceptives which are fitted in the vagina that stop the implantation of the embryo. e.g. Copper T.

179. Mention three main reasons for the sharp rise in human population in the world.

Ans : SQP 2019

- (i) Advanced medical facilities.
- (ii) Increase in the food production
- (iii) Fewer infant deaths.

180. Mention three reasons why the growth of population has not been appreciably checked in India.

Ans : COMP 2020

- (i) Children are regarded as God's gift.
- (ii) Religious beliefs.
- (iii) Illiteracy.

THREE MARKS QUESTIONS

- 181.** (i) What are the age restrictions for marriage by law for boys and girls in India?
 (ii) Name two surgical techniques (one for the human male and another for the human female) that can be used to prevent pregnancy in the female.
 (iii) Give three advantages of a small family.

Ans : SQP 2010

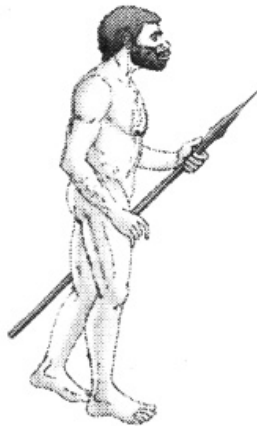
- (i) Boys – 21 years; Girls – 18 years
- (ii) Male – Vasectomy; Female – Tubectomy
- (iii) (a) Children can receive all the basic needs of life. Living environment can be improved.
- (b) Children can be provided with good education, good health of mother and child is ensured due to spacing between children.
- (c) Living standards of the family can be high which is due to the reduction of economical burden to the family.

182. Do you think that urbanization is eco-friendly? Give reasons for your answer.

Ans : COMP 2013

Urbanization cannot be termed as totally eco-friendly. Urbanization has brought in industries giving employment to people and improving their

huge nose, short stocky physique and their average height was 155 cm (1.5 m).

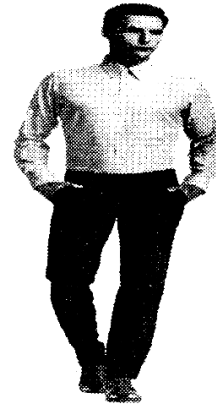


- (v) **Cro-Magnon** : They were the first early human. They lived about 30000 mya. They lived in Europe. The skull was rounded with a near vertical forehead, a large brow ridge, no prominent prognathism of the face and jaw, hard thicker teeth. Brain size 1660cc. Their forehead rises sharply, small brow ridges, prominent chin, forehead straight, location of the foramen-magnum, curvature of spine support bipedalism.



- (vi) **Modern man (Homo sapiens sapiens)**: The species to which all modern human beings belong. Carolus Linnaeus applied the name Homo sapiens. They lived around 2 mya. They emerged in Africa. These species have cranium high, rounded with thin bones, reduced face, small pronounced brow ridge. The chin was complex. They gathered and hunted food. Their jaws are less heavily developed with smaller teeth. They have a lightly built skeleton.

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1.2 Theories of Evolution

- (a) **Lamarck's theory of inheritance of acquired characteristics**: He published his findings in 1801. He stated that if an organism changes to adapt to its environment, those changes are passed on to its offspring. A more frequent and continuous use of any organ gradually strengthens, develops and enlarges that organ while permanent disuse of any organ weakens and deteriorates it.



Giraffes stretches their neck to reach leaves



Giraffes neck elongates



Giraffes acquire long neck enabling them to eat leaves easily

Theory of use and disuse: He theorised that organisms develop characteristics that they use and lose characteristics that they do not use, e.g., The ancestors of giraffe were bearing a small neck and forelimbs and were horse-like. When the surface vegetation became less, they had to stretch their neck and forelimbs to take the leaves which resulted in the slight elongation of these parts. This trait was passed on to the next generation with result of long necked and long fore-limbed giraffe was developed.

- (b) **Vestigial organs**: There are the organs that are no longer used and are non-functional. These are reduced and modified version of an ancestral organs. The examples are:
- (i) **Vermiform appendix**: It is a narrow blind tube protruding from the caecum and is located in the right-hand part of the

DIRECTION : Give technical term:

- 71.** The gradual change in the heritable traits of organism from a simple to a more complex form.

Ans : COMP 2015
Evolution

DIRECTION : Distinguish between the following on the basis of what is given in the brackets.

- 72.** Differentiate between the terms Phenotype and Genotype

Ans : SQP 2025
Phenotype — It is the observable characteristic which can be controlled genetically.
Genotype — It is the set of genes present in the cells of an organism.

- 73.** Homo erectus and Homo habilis (cranial capacity).

Ans : MAIN 2013
Homo erectus had an average cranial capacity of about 850 to 1000 cc. Homo habilis cranial capacity between 750 to 1225 cc.

- 74.** Australopithecus and Neanderthals (period of living).

Ans : SQP 2010
Australopithecus They lived around four million years ago.
Neanderthals They lived around 500000 to 600000 years ago.

- 75.** Homo erectus and Homo habilis (canine teeth).

Ans : COMP 2000
Homo erectus had large canine teeth. Homo habilis had small canine teeth.

DIRECTION : Answer the following:

- 76.** Arrange and rewrite the terms in each group in the correct order to be in a logical sequence beginning with the term that is underlined:
Australopithecus, Cro-Magnon, Homo enxtus, Neanderthal man.

Ans : MAIN 2024
Australopithecus, Homo erectus, Neanderthal man, Cro-Magnon

- 77.** State Mendel's Law of Segregation

Ans : SQP 2025
The two members of a pair of factors separate during gamete formation.

- 78.** What is natural selection by Darwin ?

Ans : MAIN 2008
Natural selection is the principle by which each slight variation of a trait is useful, is preserved.

- 79.** What is evolution?

Ans : SQP 2011
Evolution is the gradual change in the heritable characteristics of organisms from a simple to a more complex form.

- 80.** State the features Neanderthals with respect to bipedalism, cranial capacity and chin.

Ans : COMP 2015
Neanderthals walked upright and showed bipedalism. They had a cranial capacity of 1600cc and had angled cheek bones.

- 81.** Mention the period of living of Australopithecus and Homo erectus.

Ans : SQP 2010
Australopithecus lived around 5 million years ago. Homo erectus lived around 1.7 million years ago.

- 82.** How old is human evolution?

Ans : MAIN 2016
Humans first evolved in Africa. They lived between 6 and 2 mya.

- 83.** Give some characteristics of Homo sapiens.

Ans : COMP 2015
(i) Large and complex brain.
(ii) Ability to communicative in any language.
(iii) Ability to thinking and capable of reasoning.

- 84.** What was the earlist defining human trait?

Ans : MAIN 2017
Bipedalism.

- 85.** Name the book of Lamarck in which he had written the theory of evolution.

Ans : COMP 2019
Philosophic Zoologique.

- 3. Assertion (A) :** Sympathetic nervous system prepares the body for violent action against abnormal conditions.

Reason (R) : Sympathetic nervous system accelerates heartbeat.

Which of the following is correct?

- (a) Both Assertion and Reason True
- (b) Assertion is True, Reason is False
- (c) Assertion is False but Reason is True
- (d) Both Assertion and Reason are False

Ans :

MAIN 2024

The sympathetic nervous system prepares the body for action in response to stress or danger, including an increase in heart rate to supply more oxygenated blood to the muscles and organs involved in the response.

Thus (a) is correct option.

- 4.** The first scientist who proposed his theory for the evolution was.

- (a) Darwin
- (b) Mendel
- (c) Wallace
- (d) Lamarck

Ans :

MAIN 2001

Lamarck was the first to propose a formal theory of evolution, suggesting that organisms evolve by acquiring traits during their lifetime and passing them on, which influenced later evolutionary studies.

Thus (d) is correct option.

- 5.** In the evolution of man, Homo erectus is considered to be evolved from.

- (a) Dryopithecus
- (b) Ramapithecus
- (c) Cro-Magnon
- (d) Australopithecus

Ans :

SQP 2005

Homo erectus evolved from Australopithecus, showcasing developments in bipedalism and tool use, which marked a key step in the human evolutionary trajectory.

Thus (d) is correct option.

- 6.** The species of human being who lived around 2 mya.

- (a) Homo sapiens
- (b) Cro-Magnon
- (c) Neanderthals
- (d) Homo erectus

Ans :

MAIN 2007

Homo erectus lived around 2 million years ago and exhibited notable developments in tool-making and adaptability, marking a pivotal stage in the evolutionary history of humans.

Thus (a) is correct option.

- 7.** Darwin in his 'natural selection theory' did not believed in any role of which one of the following in organic evolution?

- (a) Parasites and predators as natural enemies
- (b) Discontinuous variations
- (c) Survival of the fittest
- (d) Struggle for existence

Ans :

SQP 2015

Darwin's theory focused on gradual changes through continuous variations, rejecting abrupt, discontinuous variations as a mechanism in natural selection.

Thus (b) is correct option.

- 8.** Concept of inheritance of acquired characters was disapproved by the experiments of.

- (a) Weismann
- (b) Oparin
- (c) Fox
- (d) Darwin

Ans :

COMP 2011

Weismann's experiments disproved the inheritance of acquired traits, showing that changes acquired in an individual's lifetime do not pass on genetically to the next generation.

Thus (a) is correct option.

- 9.** Lamarck's theory of evolution is also called as

- (a) theory of natural selection
- (b) survival of the fittest
- (c) theory of special creation
- (d) inheritance of acquired characters

Ans :

MAIN 2019

Lamarck's theory, known as "inheritance of acquired characters," suggested that traits developed during an organism's life could be passed to offspring, influencing evolution.

Thus (d) is correct option.

- 10.** Identify the pre-human ancestor.

- (a) Australopithecus
- (b) Ramapithecus
- (c) Neanderthal man
- (d) Cro-Magnon

Ans :

COMP 2019

Ramapithecus is considered a pre-human ancestor due to its primitive features, marking an early stage in human evolutionary history before the emergence of later hominids.

Thus (b) is correct option.

11. The false statement about Cro-Magnon man is
- he walked erect and was swift
 - he was intelligent and cultured
 - his cranial cavity was less than Homo sapiens
 - he started metal work, painting and farming

Ans :

SQP 2021

Cro-Magnon man, an early form of modern Homo sapiens, exhibited several advanced characteristics that differentiated him from earlier ancestors. However, certain statements about him do not align with historical findings.

Thus (c) is correct option.

12. The human ancestor who was called as handy man.
- Homo erectus
 - Neanderthals
 - Cro-Magnon
 - Homo-Habilis

Ans :

MAIN 2000

Homo habilis, known as the "handy man," was among the first to use stone tools, marking a significant development in early human technological skills.

Thus (a) is correct option.

13. Lamarckism fails to explain which of the following phenomenon?
- Absence of all the four limbs amongst amphibians
 - Exceptionally long neck of giraffe
 - Loss of vision in cavedwelling mammals
 - An intellectual person having a dull son

Ans :

COMP 2005

Lamarckism cannot explain why an intellectual parent might have a less intelligent child, as intelligence is influenced by both genetics and environment, not directly by acquired characteristics.

Thus (d) is correct option.

14. Darwin proposed the theory of origin of species by.
- natural selection
 - hybridisation
 - mutation
 - acquired characters

Ans :

SQP 2007

Darwin's theory of natural selection explains evolution as a process where organisms with favorable traits are more likely to survive and reproduce, passing these traits to future generations.

Thus (a) is correct option.

15. Darwin's theory of evolution fails to explain the.
- role of environment
 - overproduction
 - survival of the fittest
 - origin and transmission of variations

Ans :

SQP 2015

Darwin's theory did not address how variations originate and are transmitted across generations, as genetic mechanisms were not understood at the time.

Thus (d) is correct option.

16. The theory of Natural Selection was proposed by.
- Mendel
 - Lamarck
 - Darwin
 - Wallace

Ans :

COMP 2005

Charles Darwin proposed the theory of natural selection, describing how organisms with beneficial traits are more likely to survive and reproduce, passing these traits to future generations.

Thus (c) is correct option.

17. The common ancestor to both man and ape is.
- Australopithecus
 - Homo erectus
 - Sinanthropus
 - Dryopithecus

Ans :

MAIN 2010

Dryopithecus is considered a common ancestor to both humans and apes, displaying primitive characteristics that diverged into separate evolutionary paths for these species.

Thus (d) is correct option.

18. The speices that showed obligate bipedalism.
- Australopithecus
 - Neanderthals
 - Homo Habilis
 - Homo erectus

Ans :

SQP 2017

Homo erectus displayed obligate bipedalism,

which marked a crucial step in human evolution, as it allowed for more efficient movement and freed the hands for tool use.

Thus (c) is correct option.

- 19.** Most of the cave paintings discovered are associated with.

(a) Homo erectus
(b) Cro-Magnon man
(c) Neanderthal man
(d) Dryopithecus

Ans :

COMP 2019

Cro-Magnon man is known for creating intricate cave paintings, showcasing advanced cultural and artistic skills that reflect their cognitive and expressive abilities.

Thus (b) is correct option.

- 20.** The name Homo Sapiens can be assigned to.

(a) Java man
(b) Peking man
(c) Cro-Magnon man
(d) Shivalik man

Ans :

SQP 2021

Cro-Magnon man is considered an early form of Homo sapiens due to his anatomical similarities to modern humans and his advanced cultural practices, such as art and tool use.

Thus (c) is correct option.

- 21.** According to Lamareck, well-developed auricle muscles of rabbit have evolved due to.

(a) internal vital force
(b) continous use
(c) increasing need
(d) All of these

Ans :

COMP 2023

Lamarck theorized that traits such as the auricle muscles in rabbits evolved through internal forces, constant use, and a growing need to adapt to their environment.

Thus (d) is correct option.

- 22.** In a study of human evolution, researchers found that an ancestor species exhibited a cranial capacity of approximately 850-1000 cc. This information helps in identifying the cognitive development and lifestyle adaptations of early humans. The human ancestor who has a cranial capacity of 850-1000 cc.

(a) Homo Habilis (b) Cro-Magnon
(c) Homo sapiens (d) Homo erectus

Ans :

SQP 2000

Homo erectus had a cranial capacity ranging from 850-1000 cc, indicative of advanced cognitive abilities compared to earlier ancestors, marking an important stage in human evolution.

Thus (d) is correct option.

- 23.** Bipedal locomotion offered evolutionary benefits to early humans, enhancing their adaptability. Identifying its primary advantage sheds light on significant survival adaptations. The major advantage of bipedal locomotion is that it.

(a) releases the forelimbs for other better functions
(b) increases speed
(c) reduces body weight
(d) provides better body support

Ans :

COMP 2010

Bipedalism allowed early humans to free their hands, enabling complex tasks like tool use, which was crucial for survival.

Thus (a) is correct option.

- 24.** Australopithecus, an important ancestor in human evolution, is referred to as the "Southern ape" due to its unique combination of traits, reflecting both primitive and advanced characteristics. Australopithecus is also known as Southern ape, because it had.

(a) ape-like characters
(b) man-like characters
(c) Both (a) and (b)
(d) monkey-like characters

Ans :

SQP 2017

Australopithecus exhibited both ape-like and man-like traits, showing primitive characteristics alongside bipedalism, which linked it closely to human ancestry.

Thus (c) is correct option.

- 25.** Industrial melanism, a phenomenon observed in response to environmental changes during the Industrial Revolution, provided insights into natural selection by studying a specific organism that exhibited color variations. The organism studied for Industrial melanism was a.

(a) Moth
(b) Butterfly
(c) Honey bee
(d) Cockroach

Ans :

COMP 2010

The peppered moth was studied for Industrial melanism, as its color variations demonstrated how environmental changes influenced survival through natural selection.

Thus (a) is correct option.

DIRECTION : Matching type Question :

26. Lata tried to match human ancestors with their brain sizes. She tabulated the pairs as follows:

Theory	Description
P	Between 500-650 cc
Q	1300-1600 cc

Identify the correct pair of ancestors:

- (a) P – Australopithecus, Q – Homo habilis.
- (b) P – Homo habilis, Q – Neanderthals.
- (c) P – Homo erectus, Q – Cro-Magnon.
- (d) P – Australopithecus, Q – Neanderthals.

Ans :

Homo habilis had a brain size of about 500-650 cc, while Neanderthals had a brain size of 1300-1600 cc, which is larger than modern humans.

Thus (b) is correct option.

27. Abhay tried to match evolutionary theories with their descriptions. He tabulated the pairs as follows:

Theory	Description
P	Organisms develop characteristics by using certain body parts more
Q	Traits beneficial for survival are passed on to offspring.

Identify the correct pair of theories:

- (a) P – Darwin's theory, Q – Lamarck's theory.
- (b) P – Lamarck's theory, Q – Darwin's theory.
- (c) P – Darwin's theory, Q – Kettlewell's theory.
- (d) P – Kettlewell's theory, Q – Lamarck's theory.

Ans :

Lamarck's theory focuses on the use and disuse of organs, while Darwin's theory explains natural selection where beneficial traits are passed on to future generations.

Thus (b) is correct option.

28. Raj tried to match human ancestors with their physical features. He tabulated the pairs as follows:

Ancestor	Physical Feature
P	Protruding jaws, no chin, and large molars.
Q	Short, stocky physique and angled cheekbones

Identify the correct pair of ancestors:

- (a) P – Homo habilis, Q – Neanderthals.
- (b) P – Cro-Magnon, Q – Australopithecus.
- (c) P – Homo erectus, Q – Neanderthals.
- (d) P – Homo sapiens, Q – Homo habilis.

Identify the correct pair of ancestors:

Ans :

Homo habilis had protruding jaws, large molars, and no chin, while Neanderthals had a stocky build and prominent cheekbones.

Thus (a) is correct option.

29. Sonu tried to match human ancestors with their regions of origin. He tabulated the pairs as follows:

Ancestor	Region of Origin
P	Lived in Eastern and Southern Africa.
Q	Lived in Europe and Southern Africa.

Identify the correct pair of ancestors:

- (a) P – Homo sapiens, Q – Homo habilis.
- (b) P – Australopithecus, Q – Neanderthals.
- (c) P – Homo habilis, Q – Cro-Magnon.
- (d) P – Homo erectus, Q – Australopithecus.

Ans :

Australopithecus originated in Eastern and Southern Africa, while Neanderthals lived in Europe and Southwest Asia.

Thus (b) is correct option.

30. Lata tried to match human ancestors with their brain sizes. She tabulated the pairs as follows:

Change	Description
P	Development of chin and reduction in body hair.
Q	Bipedal locomotion and increase in cranial capacity.

Identify the correct pair of changes:

- (a) P – Modern humans, Q – Australopithecus.
- (b) P – Homo habilis, Q – Homo erectus.
- (c) P – Modern humans, Q – Homo erectus.
- (d) P – Homo sapiens, Q – Neanderthals.

Ans :

Modern humans (*Homo sapiens sapiens*) developed a chin and reduced body hair, while *Homo erectus* was the first species to show bipedal locomotion and an increase in brain size.

Thus (c) is correct option

DIRECTION : Conversation Type Question

- 31.** A biology teacher asked her students to match the human ancestors with their characteristics.

Raj said: "*Homo habilis* – called handy man and had protruding jaws."

Sonu said: "Neanderthals – had a cranial capacity larger than modern humans."

Lata said: "*Homo erectus* – the first species to show bipedalism like modern humans."

Abhay said: "*Australopithecus* – had large canine teeth and a brain size greater than 1000 cc."

Who were correct?

- (a) Raj and Abhay
- (b) Sonu and Lata
- (c) Lata and Abhay
- (d) Raj and Sonu

Ans :

Sonu correctly mentioned Neanderthals' large cranial capacity, and Lata accurately identified *Homo erectus* as the first species to exhibit bipedal locomotion similar to modern humans.

Thus (b) is correct option.

- 32.** A teacher asked her students to identify two vestigial organs in humans.

Raj said: "Vermiform appendix and wisdom teeth."

Sonu said: "Pinna and canine teeth."

Lata said: "Wisdom teeth and pinnae."

Abhay said: "Pinna and large intestine."

Who were correct?

- (a) Raj and Lata
- (b) Sonu and Abhay
- (c) Lata and Abhay
- (d) Raj and Abhay

Ans :

Raj and Lata correctly identified the appendix, wisdom teeth, and pinnae as vestigial organs, while Sonu and Abhay provided incorrect examples.

Thus (a) is correct option.

- 33.** A teacher asked her students to list two theories of evolution.

Raj said: "Lamarck's theory of inheritance and Darwin's theory of natural selection."

Sonu said: "Darwin's theory of survival of the fittest and Lamarck's theory of evolution through vestigial organs."

Lata said: "Darwin's theory of natural selection and Kettlewell's theory of moth evolution."

Abhay said: "Lamarck's theory of use and disuse and Darwin's theory of natural selection."

Who were correct?

- (a) Raj and Abhay
- (b) Sonu and Lata
- (c) Lata and Abhay
- (d) Raj and Sonu

Ans :

Raj and Abhay both correctly identified Lamarck's theory of inheritance of acquired characteristics and Darwin's theory of natural selection as valid evolutionary theories.

Thus (a) is correct option.

- 34.** A teacher asked her students to match the following species with their brain sizes.

Raj said: "*Australopithecus* – 500 cc."

Sonu said: "*Homo erectus* – 800 cc."

Lata said: "Neanderthals – 1300-1600 cc."

Abhay said: "*Homo habilis* – 1100 cc."

Who were correct?

- (a) Raj and Lata
- (b) Sonu and Abhay
- (c) Lata and Abhay
- (d) Raj and Sonu

Ans :

Raj correctly identified *Australopithecus* with 500 cc brain size, and Lata correctly identified Neanderthals with 1300-1600 cc brain size.

Thus (a) is correct option.

- 35.** A teacher asked her students to describe two major evolutionary changes in humans from apes.
- Raj said: "Development of chin and reduction of body hair."

Sonu said: "Bipedal locomotion and development of canine teeth."

Lata said: "Increase in cranial capacity and reduction of body hair."

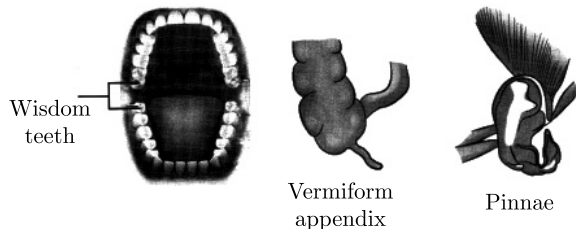
Abhay said: "Increase in height and larger brow ridges."

Who were correct?

- (a) Raj and Lata
- (b) Sonu and Abhay
- (c) Lata and Abhay
- (d) Raj and Sonu

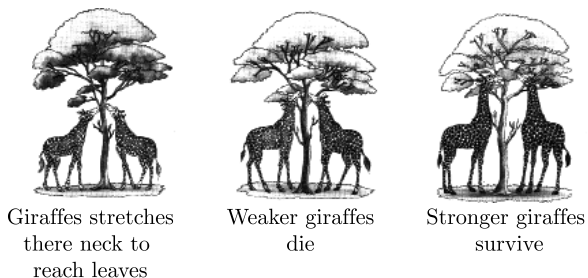
abdomen. In humans, the appendix has lost all or most of the original function through evolution. However in other animals it has digestive function.

- (ii) Wisdom teeth are the third and final set of molars. Most people get them in their early twenties. In some people, molar teeth are useful while for other, if they do not come through properly they may need to be removed.
- (iii) Pinnae or outer ears are the external parts of the ear in humans. Pinnae do not have any function. In other animals they move to detect sound. The muscles of pinnae are vestigial since we cannot move pinnae.



- (c) **Darwin's theory of evolution:** Charles Darwin was a British naturalist who proposed the theory of natural selection. He defined natural selection as the principle by which each slight trait, if useful is preserved by nature. In his book 'Origin of the species' published in 1859, described survival of the fittest as mechanism of natural selection that is reproductive success.

Example 1:



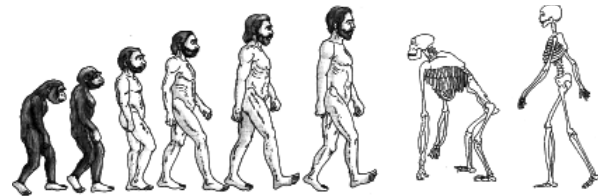
Example 2:

Peppered moth. Bernard Kettlewell investigated the evolutionary mechanism behind peppered moth before industrialisation and after industrialisation. It is found in two varieties, light gray and dark gray. They are nocturnal in nature. The dark coloured moths was found to survive and reproduce due to the dark colour trunk of the tree caused by industrial pollution while the

white moth did not survive. This is a particular type of natural selection.



White-winged and Dark-winged moths (a) Before Industrialisation, (b) After Industrialisation



Various stage of man and Evolutionary

Major changes that took place from ape form to human are:

1. Chin development
2. Reduced body hair
3. Bipedal locomotion and erect posture.
4. Cranial shows increasing capacity.
5. Increase in height.
6. Size of canine teeth reduced.

MULTIPLE CHOICE QUESTION

1. While studying the stages in the evolution of man, a well-developed chin is observed in
- (a) Homo habilis
 - (b) Homo erectus
 - (c) Homo sapiens
 - (d) Australopithecus

Ans :

SQP 2025

Thus (c) is correct option.

2. Industrial Melanism was observed in:
- (a) Mice
 - (b) Peppered moth
 - (c) House flies
 - (d) Crow

Ans :

MAIN 2024

Industrial Melanism was observed in the peppered moth. This phenomenon refers to the evolutionary adaptation of the moth's coloration in response to environmental changes, particularly pollution from industrial activities.

Thus (b) is correct option.

- 53.** The species that showed obligate bipedalism.
(Australopithecus, Homo habilis, Neanderthals, Homo erectus).

Ans : MAIN 2010

Homo habilis

- 54.** The human ancestor who was called as handy man.
(Homo erectus, Neanderthals, Cro-Magnon, Homo habilis)

Ans : COMP 2018

Homo habilis

- 55.** The human ancestor who had a cranial capacity of 850-1000 cc.
(Homo habilis, Homo erectus, Homo sapiens, Cro-Magnon)

Ans : MAIN 2019

Homo erectus.

- 56.** The first hominine species who showed bipedalism.
(Homo habilis, Cro-Magnon, Neanderthals, Australopithecus)

Ans : COMP 2012

Homo habilis

- 57.** The immediate ancestor of human being.
(Homo habilis, Australopithecus, Neanderthals, Cro – Magnon)

Ans : SQP 2015

Australopithecus

- 58.** The theory of use and disuse was proposed by.
(Charles Darwin, Lamarck, Carl Linnaeus, Aristotle)

Ans : COMP 2017

Lamarck.

- 59.** A human ancestor who had large molars and no chin.
(Australopithecus, Cro-Magnon, Homo habilis, Neanderthals).

Ans : SQP 2019

Homo habilis

- 60.** The cranial capacity of Neanderthals.
(1600cc, 850cc, 100cc, 500cc)

Ans : MAIN 2011

1600cc

- 61.** Who had small pronounced browridge and reduced face?
(Neanderthals, Homo sapiens, Cro-Magnon, Homo erectus.)

Ans : COMP 2015

Homo sapiens.

DIRECTION : Complete the following:

- 62.** The example given by Lamarck for his theory use and disuse is _____.

Ans : SQP 2017

Giraffe

- 63.** _____ was Charles Darwin's book.

Ans : MAIN 2019

Origin of species

- 64.** The brain size of Cro-Magnon was _____ cc.

Ans : COMP 2011

1350

- 65.** Angled cheek bones were found in _____.

Ans : SQP 2013

Neanderthals

- 66.** _____ showed obligate bipedalism.

Ans : MAIN 2015

Homo habilis

- 67.** _____ wrote 'Origin of species'.

Ans : COMP 2011

Charles Darwin

- 68.** The theory of acquired inheritance was proposed by _____.

Ans : MAIN 2017

Lamarck

- 69.** _____ was called as skillful person.

Ans : COMP 2019

Homo habilis

- 70.** The brain size of Neanderthals was _____.

Ans : SQP 2011

1400cc.

Ans :

Raj correctly identified chin development and reduced body hair, and Lata correctly mentioned the increase in cranial capacity and reduction in body hair as major evolutionary changes.

Thus (a) is correct option.

ONE MARK QUESTIONS

DIRECTION : Name the following:

36. The birth place of human beings.

Ans :

SQP 2020

Africa

37. The person who proposed the theory of use and disuse of organs.

Ans :

COMP 2000

Jean Baptiste de Lamarck

38. The theory of natural selection was written by –

Ans :

SQP 2006

Charles Darwin

39. Who wrote Origin of species?

Ans :

MAIN 2011

Charls Darwin

40. The immediate ancestor of modern human being.

Ans :

COMP 2017

Cor-Magnon man

41. The human ancestor who lived in Eastern and Southern Africa.

Ans :

SQP 2019

Homo habilis

42. The first hominine who shows bipedal locomotion.

Ans :

MAIN 2000

Homo erectus

43. The first human ancestor who walked upright.

Ans :

COMP 2001

Neanderthals

44. The human ancestor who had rounded skull and a vertical forehead.

Ans :

SQP 2005

Cro-Magnon

45. The name Homo sapiens to human beings was given by –

Ans :

COMP 2010

Carolus Linnaeus

46. Handy man of the human ancestor.

Ans :

SQP 2011

Homo habilis

47. The scientific name of human being.

Ans :

MAIN 2015

Homo sapiens

48. The human ancestor who had reduced canine teeth.

Ans :

COMP 2015

Australopithecus.

49. The structure which is an evidence of bipedal locomotion.

Ans :

SQP 2017

Foramen magnum.

50. A vestigial organ in human.

Ans :

MAIN 2019

Vermiform appendix

51. The birth place of human beings.

Ans :

COMP 2021

Africa

DIRECTION : Choose the correct option from the brackets and complete.

52. The species of human being who lived around 2 mya.
(Cro-Magnon, Homo sapiens, Neanderthals, Homo erectus).

Ans :

SQP 2000

Homo sapiens

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86. Which creature was closely related to humans? When did they evolve?

Ans : SQP 2021

Neanderthals – They evolved around 500000 to 600000 mya.

TWO MARKS QUESTIONS

87. Explain the theory of inheritance of acquired characters.

Ans : COMP 2000

The theory states that if an organism changes to adapt to its environment, those changes are passed on to its offspring, i.e. Physiological changes acquired over the life of an organism may be transmitted through offspring.

88. Taking an example explain the theory of use and disuse.

Ans : SQP 2001

The theory of use and disuse was proposed by Lamarck. He theorised that organism lose characteristics they do not require and developed characteristics that are useful, e.g. The neck of giraffe was long because it stretched to reach leaves on high trees.

89. Define evolution.

Ans : MAIN 2005

Evolution is the gradual change in the heritable characteristics of organisms from a simple to a more complex form.

90. With respect to disuse of organs, explain vermiform appendix and wisdom teeth.

Ans : SQP 2015

Wisdom teeth probably once served a function. But the human jaw and wisdom teeth has become smaller overtime the wisdom teeth nowhere to grow.

Vermiform appendix is a small pouch attached to large intestine, the junction of small intestine, no longer aids in digestion.

91. What function did the wisdom teeth perform?

Ans : COMP 2017

Wisdom teeth are the third set of molars beneficial for our ancestors early diet of coarse, rough food which require more chewing power and resulted in excessive wear of the teeth.

92. Explain Natural selection.

Ans : MAIN 2019

Charles Darwin proposed the theory of natural selection. It is defined as the principle by which each slight trait, if useful is preserved by selectively reproducing changes in its genotype.

93. State the two features of Australopithecus.

Ans : SQP 2020

- (i) The brain size of Australopithecus was less than 500cc.
- (ii) Their canine teeth was smaller than apes.

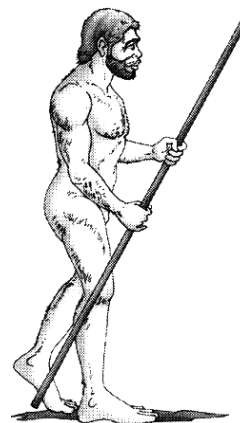
94. When did Cro – Magnon man appear? State the distinguishing features of them.

Ans : MAIN 2010

They appeared about 30000 mya.

- (i) They had a large brow ridge.,
- (ii) Their skull was rounded.
- (iii) They had thicker teeth.

95. Study the figure and answer the following.



- (i) What is shown in the figure?
- (ii) State their features.

Ans : COMP 2012

- (i) Homo erectus.
- (ii) Their cranial capacity was about 850 to 1000cc. Their hip bones were smaller than modern man. They had large canine teeth.

96. Taking example of giraffe, explain use and disuse of organs.

called radioactive elements e.g. radium, thorium, uranium, etc.

Sources of radioactive pollution :

- (a) Natural (Background) radiation.
 - (i) Cosmic rays from outer space.
 - (ii) Terrestrial radiation from radioactive/radioisotopes present in earth e.g. strontium, uranium, radium and caesium.
- (b) Man-made radiation.
 - (i) mining and refining of plutonium, thorium, caesium, uranium used in atomic i.e., power plants, nuclear weapon, preparation of radioactive isotopes, nuclear fall out, X-rays etc.

Effects of radioactive pollutants depend upon its

- (i) half life.
- (ii) energy releasing capacity.
- (iii) rate of diffusion.
- (iv) rate of deposition.
- (v) climatic conditions.

All the organisms are affected by radioactive pollution to a varied degree. The actively growing and dividing cells are quickly damaged by radiations. The various effects of radiation on human beings include.

- (a) sun burn-causing reddening of skin and blisters.
- (b) Snow blindness-cornea turns opaque.
- (c) cancer-accumulation of strontium causes bone cancer.
- (d) Inactivation of biomolecules such as proteins, RNA, DNA and pigments of plants.
- (e) Genetic disorders are caused due to mutations in DNA.

Control of radioactive pollution : involves measures such as

- (i) Leakage of radioactive materials from nuclear reactors laboratories and industries using them should be totally checked.
- (ii) Radioactive wastes disposal must be safe, by changing into harmless form or stored in safe places, to decay in a harmless manner.
- (iii) Preventive measures should be taken so that natural radiation level does not rise above the permissible limits.
- (iv) Safety measures should be taken against accidents in nuclear power plants.
- (v) Workers using radio active materials should wear protective garments.

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MULTIPLE CHOICE QUESTION

1. The prime source of chlorofluorocarbons is :
 - (a) Vehicular emissions
 - (b) Industrial effluents
 - (c) Domestic sewage
 - (d) Refrigeration equipments

Ans :

SPQ 2017

Refrigeration equipment is the main source of CFCs, which, when released, contribute significantly to ozone layer depletion. Thus (d) is correct option.

2. Which one of the following is a Greenhouse gas ?
 - (a) Oxygen
 - (b) Methane
 - (c) Sulfur dioxide
 - (d) Nitrogen

Ans :

MAIN 2018

Methane is a greenhouse gas that traps heat in the atmosphere, playing a significant role in the greenhouse effect and global warming. Thus (b) is correct option.

3. Which one the following is an example of pollutant?
 - (a) A rat entering your kitchen.
 - (b) The dust raised during road-cleaning.
 - (c) CO₂ given out by the respiring organisms.
 - (d) The heat given out while cooking food.

Ans :

SPQ 2019

Dust raised during road-cleaning disperses particulate matter into the air, which can harm respiratory health and contribute to pollution. Thus (b) is correct option.

4. Which of the following is a green house gas ?
 - (a) CO₂
 - (b) O₂
 - (c) Nitrogen
 - (d) CO

Ans :

SQP 2000

CO₂ is a greenhouse gas because it traps heat in the Earth's atmosphere, leading to warming. It absorbs and re-radiates infrared radiation (heat) back towards the Earth's surface, creating the greenhouse effect. In contrast, O₂ and N₂ do not trap heat, and CO is not a significant greenhouse gas.

Thus (a) is correct option.



- (i) Identify the figure.
- (ii) State the features of the figure.

Ans :

MAIN 2014

- (i) Australopithecus.
- (ii) They had a flat nose, strongly projecting lower jaw, their brain size was less than 500cc. Their canine teeth were reduced in size. They showed bipedalism.

102. Study the figure:



- (i) What does the figure depict?
- (ii) State the features of it.

Ans :

MAIN 2012

- (i) Homo habilis.
- (ii) They showed obligate bipedalism. They had protruding jaws. Their brain size was 750 to 1225cc.

103. Explain natural selection by taking peppered moth as an example.

Ans :

COMP 2017

Charles Darwin was a British naturalist who proposed the theory of natural selection. He

defined natural selection as the principle by which each slight trait, if useful is preserved by nature. In his book 'Origin of the species' published in 1859, described survival of the fittest as mechanism of natural selection that is reproductive success, e.g. Peppered moth. Bernard Kettlewell investigated the evolutionary mechanism behind peppered moth. It is found in two varieties, light gray and dark gray. They are nocturnal in nature. The dark coloured moths were found to survive and reproduce due to the dark colour trunk of the tree caused by industrial pollution while the white moth did not survive. This is a particular type of natural selection.

CASE BASED QUESTION

104. Australopithecus, one of the earliest human ancestors, evolved in Africa. They had small brains and reduced canine teeth. Over time, species like Homo habilis and Homo erectus appeared, showing increasing brain size and bipedalism.

1. What evolutionary change is seen in Australopithecus?
2. How did Homo habilis differ from Australopithecus?
3. What does bipedalism indicate about human evolution?
4. Where did Australopithecus evolve?

Ans :

1. Reduced canine teeth and small brain size.
2. Homo habilis showed tool use and had a slightly larger brain.
3. It shows adaptation to walking on two legs.
4. Australopithecus evolved in Africa.

105. Homo habilis, an early ancestor, lived in Africa around 2.4 million years ago. They were the first to show evidence of tool use and bipedalism, marking a significant step in human evolution.

1. What skill did Homo habilis develop?
2. What physical trait helped Homo habilis with bipedalism?
3. Where did Homo habilis live?
4. How long ago did Homo habilis exist?

Ans :

1. Tool use.
2. The position of the foramen magnum supported upright walking.

3. Homo habilis lived in Africa.
4. Around 2.4 million years ago.

106. Homo erectus originated in Africa and spread to other parts of the world. They had larger brains than earlier ancestors and demonstrated advanced bipedalism, which resembled modern humans.

1. Where did Homo erectus originate?
2. What advancement did Homo erectus show?
3. How did the brain size of Homo erectus compare to earlier ancestors?
4. What was a key feature of Homo erectus?

Ans :

1. Homo erectus originated in Africa.
2. They had advanced bipedalism.
3. It was larger than earlier ancestors.
4. Upright walking and bipedalism.

107. Neanderthals lived in Europe and Asia and had larger cranial capacities than modern humans. They adapted to cold climates and had strong physical features such as thick brow ridges and stocky bodies.

1. Where did Neanderthals live?
2. What was the brain size of Neanderthals?
3. What physical adaptation helped Neanderthals survive cold climates?
4. What feature distinguished Neanderthals?

Ans :

1. In Europe and Asia.
2. Larger than modern humans.
3. Their stocky, muscular bodies.
4. Thick brow ridges and large brains.

108. Cro-Magnon were early humans living in Europe around 30,000 years ago. They had larger brains than Neanderthals, prominent chins, and demonstrated advanced tool-making and hunting skills.

1. Where did Cro-Magnon live?
2. What was the brain size of Cro-Magnon?
3. What physical feature distinguished Cro-Magnon?
4. What skill did Cro-Magnon develop?

Ans :

1. In Europe.
2. Larger than Neanderthals
3. Prominent chin and near-vertical forehead.
4. Advanced tool-making and hunting skills

CHAPTER 14

POLLUTION

1. POLLUTION

Pollution can be defined as an undesirable change in the physical, chemical or biological characteristics of environment. Pollution need not always be caused by chemical substances such as particulates (like smoke and dust). Forms of energy such as sound, heat or light can also cause pollution.

Agents causing pollution are called pollutants. Pollutant may be

- (i) Quantitative e.g. CO_2 and
- (ii) Qualitative e.g. pesticides synthesized and released by man

Depending upon their ability to degrade, pollutants can be classified as

- (i) Biodegradable e.g. sewage, vegetable peels etc. and.
- (ii) Non-biodegradable e.g. DDT, plastic, glass, etc.

2. TYPES OF POLLUTION

As stated before, there are different types of pollution, which are either caused by natural events (like forest fires) or by man-made activities (like cars, factories, nuclear wastes, etc.) These are further classified into the following types of pollution:

2.1 Air Pollution

Air pollution is defined as the occurrence of foreign particles or gases into the atmosphere which are harmful to man, vegetation, animals and buildings.

Sources of air pollution :

Automobile exhaust, industrial waste (SO_2 , CO , CO_2 , H_2S , NO , smoke, dust, fly ash etc.) burning garbage, smoke from brick-kilns, thermal plants, etc.

Effects of air pollutants :

- (i) Respiratory problems such as bronchitis, asthma and lung diseases
- (ii) Dioxin a harmful pollutant released during garbage burning is a carcinogen.
- (iii) Acid rains, increase soil acidity affecting land

flora and fauna, acidification of lakes affecting aquatic life, corrosion of marble buildings, monuments, statues etc.

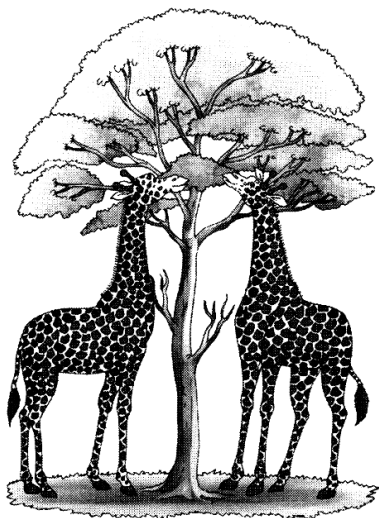
- (iv) Oxides of N_2 , decrease the oxygen carrying capacity of blood.
- (v) Smoke and dust particles form a thin layer on the leaves to reduce light absorption and hence photosynthesis, cause leaf fall in legumes, necrosis and chlorosis of margins and tips of leaves caused by hydrogen fluorides.
- (vi) Thinning of ozone layer by release of aerosols such as CCl_4 , producing skin cancer and other eye disorders due to increased UV radiations.
- (vii) Smog containing secondary pollutants such as PAN, cause glazing, silvering and sometimes necrosis of sensitive species resulting in crop losses, Green house effect is a natural phenomenon which helps in heating the earth's surface and atmosphere just right (average 15°C), suitable for life on this planet. CO_2 , H_2O vapour and methane are the green house gases producing this effect by radiating back the long wave radiations emitted from earth's surface. Rise in CO_2 content, due to some human activities, have increased the intensity of this effect, resulting in the rise of global temperature called global warming. It may lead to melting of glaciers and polar ice caps, thereby flooding of coastal plains.

Control of air pollution :

- (i) Establishment of industrial estates away from residential areas.
- (ii) Compulsory use of filters, scrubbers and electrostatic precipitator and catalytic converters in automobiles.
- (iii) use of unleaded sulphur free gasoline.
- (iv) Afforestation and reforestation of waste lands and the mining area on priority basis.
- (v) Use of unconventional sources of energy.

2.2 Water Pollution

It is defined as the decrease in quality of water by the presence of various solid and liquid wastes (organic, inorganic biological, radiological) or factor (heat) which degrades the quality of water

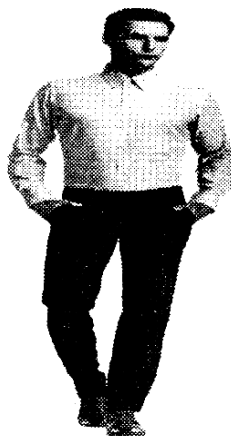


Ans :

SQP 2014

Lamarck believed that organisms lose traits that they do not use, while they develop traits that they use, e.g. Giraffe stretched their neck to reach the high leaves. Their off springs and later generations inherited the resulting long necks.

97. Study the figure and answer:



- (i) Mention the scientific name of the, figure.
- (ii) State its features.

Ans :

MAIN 2015

- (i) Homo sapiens.
- (ii) Their cranium is high, rounded with thin bones. They have small pronounced brow ridges and show bipedalism.

98. Define:

- (i) The theory of inheritance of acquired characteristics.
- (ii) Evolution.

Ans :

SQP 2017

- (i) The theory states that if an organism changes to adapt to its environment, those changes are passed on to its offspring.
- (ii) Evolution is the gradual change in the heritable characteristics of organisms from a simple to a more complex form.

99. Distinguish between:

- (i) Homo erectus and Homo habilis.
- (ii) Australopithecus and Neanderthals.

Ans :

MAIN 2019

- (i) Homo erectus : Their cranial capacity was 750 to 1100cc. They had larger canine teeth.
 - (ii) Homo habilis : Their cranial capacity was between 650 to 800cc. They had larger molars.
- Australopithecus : Their cranial capacity was less than 500cc. They had smaller canine teeth. Neanderthals : Their cranial capacity was 1600cc. They had long pointed canine teeth.

THREE MARKS QUESTIONS

100. The figure shows a human ancestor. Study it and answer the following.



- (i) Identify the figure.
- (ii) Mention the structures that support bipedalism.
- (iii) Where did they live?

Ans :

COMP 2011

- (i) Cro-Magnon.
- (ii) Location of foramen magnum and curvature of the spine support bipedalism.
- (iii) They lived in Europe.

101. Study the skull of human ancestor and answer the following.

lands in to barren area.

- (ii) Accumulated urban, commercial and domestic wastes pollute the soil, become breeding ground for mosquitoes and flies, emit foul smell due to decomposition, release toxic acids that leach down the soil, destroy the vegetation.
- (iii) Agricultural chemicals being persistent broad spectrum affect other animals, man and plants. They tend to accumulate inside living organisms e.g. DDT and undergo biological amplification, proving fatal to higher trophic level animals especially fish and birds.
- (iv) Untreated infected biomedical wastes help in spreading diseases, mix with soil and pollute it.
- (v) Excessive use of fertilizers cause soil deterioration through the decrease in natural bacterial population.
- (vi) Mine dust destroys vegetation, cause deformities and diseases in animals and human beings.
- (vii) Acid rains cause soil pollution, kill the essential soil microorganisms and induce toxicity in the soil for plant growth.

Control of soil pollution :

- (i) Judicious use of agricultural pesticides and fertilizers.
- (ii) Cropping techniques such as crop rotation and mixed cropping result in improving soil fertility.
- (iii) Improvement in mining techniques and transport of extracted materials.
- (iv) Restoring forests, grassland cover, controlled grazing check soil erosion, flood and water logging.
- (v) Special pits or low lying areas in vacant, lands outside city be selected for dumping of non-biodegradable waste. Biodegradable wastes be converted in to composite manures.
- (vi) Biomedical wastes should be incinerated.
- (vii) Recycling and recovery of wastes.

2.4 Noise Pollution

Noise can be defined as unwanted sound which interferes with human communication, comfort, health, etc.

Sources of noise pollution :

Sources of noise pollution are as follows.

- (i) Automobiles, trains and other means of road transportation.
- (ii) Jet airplane.
- (iii) work shops.

- (iv) Industries.
- (v) Electric appliances used in kitchen and houses.
- (vi) Agricultural machines like tractors, harvestors etc
- (vii) Operations such as blasting, bulldozing, construction work, stone crushing etc.
- (viii) Public address systems such as loud speakers and entertainment equipment like radios, record players, musical bands, television sets, etc.

Effects of noise pollution include :

- (i) Temporary or permanent hearing loss due to continued high intensity noise. A sudden loud noise may damage ear drum.
- (ii) Cause anxiety and stress, blood pressure by increasing cholesterol level.
- (iii) Cause headache by dilating blood vessels of the brain.
- (iv) Disturbs sleep and leads to nervous irritability.
- (v) Lowers efficiency of work.
- (vi) Affects concentration of thought.
- (vii) Interferes in communication.

Control of noise pollution :

- (i) Aerodromes, Industrial zones should be far away from human settlements.
- (ii) Proper lubrication and maintenance of machines
- (iii) Enclosure of machinery with sound absorb materials.
- (iv) Protection of workers through devices such as ear muffs or cotton plugs.
- (v) Use of loudspeakers and amplifiers be restricted to a fixed intensity and fixed hours of the day.
- (vi) Blowing of horns should be totally banned especially near hospitals and schools by creating silence zones.
- (vii) Creation of 'Green belt' vegetations and open spaces in metropolitan cities, along highway and streets are effective in absorbing and deflecting the noise upward in the air.
- (viii) Legal enforcement of specific legislation and regulation on noise pollution.

2.5 Radioactive Pollution

Radioactive pollution is the physical pollution contamination of air, water and soil with radioactive materials.

Radioactivity is the property of certain elements to spontaneously emit protons, electrons and gamma rays as a result of disintegration of atomic nuclei. The elements which emit radiations are

14. An example of non-biodegradable waste
 (a) Vegetable peels (b) Sewage
 (c) DDT (d) Livestock wastes

Ans : SQP 2009

DDT is a non-biodegradable waste, meaning it does not decompose easily and can persist in the environment, leading to pollution and bioaccumulation.

Thus (c) is correct option.

15. The gradual continuous increase in average temperature of surface of the earth as a result of increase in concentration of CO₂ and CFCs is termed as

- (a) Greenhouse effect
 (b) Global warming
 (c) Ozone degradation
 (d) Montreal protocol

Ans : MAIN 2010

Global warming refers to the rise in Earth's surface temperature due to greenhouse gases like CO₂ and CFCs, contributing to climate change.

Thus (b) is correct option.

16. The greenhouse gases
 (a) Decrease the temperature
 (b) Keep the planet warm
 (c) Radiate the heat of earth
 (d) Trap the harmful rays

Ans : COMP 2015

Greenhouse gases keep the planet warm by trapping heat in the atmosphere, maintaining Earth's temperature and supporting life.

Thus (b) is correct option.

17. Which one is non-biodegradable?
 (a) DDT
 (b) Vegetable peels
 (c) Livestock waste
 (d) Sewage

Ans : MAIN 2005

DDT is non-biodegradable, meaning it remains in the environment without decomposing, causing prolonged pollution and bioaccumulation.

Thus (a) is correct option.

18. An example of non-biodegradable waste is
 (a) Vegetable peels
 (b) Sewage
 (c) DDT
 (d) Livestock waste

Ans : SQP 2018

DDT is a non-biodegradable waste, persisting in the environment and causing bioaccumulation, which can be harmful to ecosystems.

Thus (c) is correct option.

19. The BS emission norms enforced for the entire country on April 1st 2017 were -

- (a) BS III
 (b) BS VI
 (c) BS V
 (d) BS IV

Ans : COMP 2000

BS IV emission norms were enforced across India on April 1st, 2017, aiming to reduce vehicular emissions and improve air quality.

Thus (d) is correct option.

20. The noise level that may lead to pain and physical discomfort is

- (a) 50 dB
 (b) 80 dB
 (c) 120 dB
 (d) 60 dB

Ans : COMP 2010

Noise levels around 120 dB can cause pain and discomfort, as this intensity is typically associated with harmful auditory and physical effects.

Thus (c) is correct option.

21. Which one of the following is a greenhouse gas ?
 (a) Methane
 (b) Oxygen
 (c) Sulphur dioxide
 (d) Nitrogen

Ans : MAIN 2015

Methane is a powerful greenhouse gas that traps heat in the atmosphere, contributing significantly to global warming and climate change.

Thus (a) is correct option.

22. Pollution can be defined as :

- (a) A desirable change in the biological characteristics of the environment
 (b) An undesirable change in the physical, chemical, or biological characteristics of the environment
 (c) A natural change in the environmental balance
 (d) A change in only the chemical characteristics of the environment

5. The prime source of chlorofluorocarbons is:

- (a) Refrigeration equipments
- (b) Vehicular emissions
- (c) Industrial effluents
- (d) Domestic sewage

Ans :

COMP 2020

Refrigeration equipment is the main source of CFCs, which are harmful to the ozone layer when released into the atmosphere.

Thus (a) is correct option.

6. Eutrophication leads to death of fish due to

- (a) Increased O_2 content
- (b) Increased algal content
- (c) Decreased algal content
- (d) Decreased O_2 content

Ans :

MAIN 2023

Eutrophication increases algal growth, which, upon decay, depletes oxygen in the water, leading to hypoxic conditions that can result in fish deaths.

Thus (d) is correct option.

7. International ozone day is on

- (a) 11th July
- (b) 16th August
- (c) 5th June
- (d) 16th September

Ans :

MAIN 2013

International Ozone Day, celebrated on 16th September, promotes awareness and action to protect the ozone layer.

Thus (d) is correct option.

8. The unfavourable alteration of environment due to human activities is termed as

- (a) Pollution
- (b) Ecological disturbance
- (c) Catastrophe
- (d) Ecological degradation

Ans :

COMP 2019

Pollution refers to the adverse changes in the environment caused by human activities, which can harm ecosystems and health.

Thus (a) is correct option.

9. An increased rate of greenhouse gases causes

- (a) Depletion of ozone layer
- (b) Eutrophication
- (c) Global warming
- (d) Algal bloom

Ans :

SPQ 2010

The rise in greenhouse gases traps more heat in the atmosphere, leading to global warming and impacting climate patterns worldwide.

Thus (c) is correct option.

10. The primary source of chlorofluorocarbons is

- (a) Vehicular emissions
- (b) Refrigeration equipments
- (c) Industrial effluents
- (d) Domestic sewage

Ans :

MAIN 2007

Refrigeration equipment is a major source of CFCs, which, when released, contribute significantly to ozone layer depletion.

Thus (b) is correct option.

11. Which one of the following is non-biodegradable?

- (a) Vegetable peel
- (b) DDT
- (c) Cardboard
- (d) Bark of trees

Ans :

COMP 2009

DDT is non-biodegradable, meaning it remains in the environment for a long time, leading to accumulation and potential harm to ecosystems.

Thus (b) is correct option.

12. CFCs cause

- (a) Depletion of CO_2
- (b) Increase of ozone layer
- (c) Depletion of ozone layer
- (d) Increase of CO_2

Ans :

COMP 2004

CFCs contribute to ozone layer depletion by breaking down ozone molecules, reducing the layer's ability to shield Earth from harmful UV radiation.

Thus (c) is correct option.

13. Which of the following is a non-biodegradable pollutant?

- (a) Paper
- (b) Wood
- (c) Cloth
- (d) DDT

Ans :

MAIN 2005

DDT is a non-biodegradable pollutant that remains in the environment for extended periods, causing bioaccumulation and ecological harm.

Thus (d) is correct option.

to make it unfit for human use.

Major sources of water pollution :

Major Sources of water pollution can be categorized as:

- (i) Household detergents mainly composed of phosphates.
- (ii) Domestic sewage (human excreta, household wastes, kitchen washings, bathing, infectious agents for various diseases-bacteria, eggs of parasites and their cysts.
- (iii) Organic industrial wastes from tanneries, slaughter houses and canning industries.
- (iv) Industrial wastes from chemical, textile and distillery industries, include heavy metals such as arsenic, cadmium, mercury, lead, cyanides etc.
- (v) Oil spills, during transportation and unloading of oil tankers.
- (vi) Agricultural-run-off of herbicides, pesticides, fertilizer, etc.
- (vii) Thermal pollution caused by addition of heated gases or heated water or effluents and hot water bodies.
- (viii) Pollution of sea, due to direct dumping of industrial wastes from coastal industries, sewage of coastal cities.

Effects of water pollutants :

Effects of water pollutants on the health of man and other organisms :

- (i) Pathogens contaminated water cause cholera, typhoid, amoebic dysentery jaundice and skin diseases.
- (ii) Decomposition of organic wastes by microbes take up oxygen present dissolved in water resulting in death of aquatic animals.
- (iii) Oil spills prevents the oxygenation of sea water, thereby affecting marine organisms.
- (iv) Toxic chemicals such as DDT and heavy metals released in water bodies, undergo bio-magnification as they pass through successive tropic levels of a food chain. It adversely effects the human beings and the population of many birds.
- (v) Thermal pollution, cause deoxygenation. Thereby decrease in the rate of decomposition of organic matter, replacement of green alga, by less desirable, blue green algae, animals fail to multiply thus adversely affecting flora and fauna.
- (vi) Flow of fertilizers rich water from fields to water bodies results in eutrophication i.e. algal bloom, which increase organic loading of water body. This further results in oxygen

depletion and hence death of aquatic animals.

- (vii) Radioactive wastes released in water bodies are assimilated by aquatic organisms. They cause ionization of body fluids and mutations.

Control of water pollution :

Control of water pollution can be done by.

- (i) Recirculation of waste materials within the industry.
- (ii) Recycling of waste such as gobar gas plant.
- (iii) Judicious use of fertilizers, weedicides and pesticides.
- (iv) Sewage pollutants are subjected to primary treatment and secondary treatment, to make it non-toxic before passing it in to lakes and rivers.
- (v) Reverse osmosis converts the sewage water into fairly clean drinking water.
- (vi) Thermal pollution can be reduced by using cooling ponds, wet cooling towers etc.

2.3 Soil Pollution

Soil pollution is defined as the decrease in soil fertility because of the addition of some foreign elements and factors. Soil erosion is caused by two factors water and wind, Destruction of forests in the catchment area of rivers by excessive felling and overgrazing is the major cause.

Sources of soil pollution :

Sources of soil pollution are as follows :

- (i) Industrial wastes, both solids and liquids are dumped over the soil. The wastes include toxic chemicals, acids, alkalies, organic solvents.
- (ii) Surface mining and strip mining remove top soil and also spread mine dust over a large area during transportation.
- (iii) Urban, commercial and domestic wastes are dumped in open areas inside and outside the city. The wastes include odd scraps, newspapers, wooden furniture, peelings of vegetables and fruits, lawn trimmings, glass can, broken appliances, plastic etc.
- (iv) Agricultural chemicals such as pesticides, weedicides and fertilizers used to protect the crops and increase the yield of crops, when used in excess, cause deterioration of soil structure, underground water, affects other useful harmless insects beside killing target insects, thereby producing adverse ecological effects of substances.
- (v) Biomedical waste is another source of soil pollution.

Effects of soil pollutants :

- (i) The toxic industrial wastes convert the fertile

Ans :

Pollution is described as an unwanted change affecting the environment's physical, chemical, or biological aspects, which can disrupt natural balance. Thus (b) is the correct option.

- 23.** Ravi is learning about diseases and their causes. He finds that some illnesses spread due to contaminated water, making it important to identify such waterborne diseases. Which among the following diseases is caused by water pollution?
- Measles
 - Tuberculosis
 - Hemophilia
 - Typhoid

Ans :

COMP 2018

Typhoid is caused by consuming water contaminated with bacteria, often due to poor sanitation, making it a waterborne disease linked to pollution.

Thus (d) is correct option.

- 24.** Which of the following is NOT an example of a pollutant in the form of energy?
- Sound
 - Heat
 - Light
 - Dust

Ans :

While sound, heat, and light are energy forms that can cause pollution, dust is a particulate matter pollutant, not an energy form.

Thus (d) is the correct option.

- 25.** If DDT is sprayed in a lake, its highest concentration will be found in
- Phytoplanktons
 - Zooplanktons
 - Fishes
 - Fish eating birds

Ans :

COMP 2017

DDT concentration is highest in fish-eating birds due to bio-magnification, where toxins accumulate at greater levels in organisms higher up the food chain.

Thus (d) is correct option.

- 26.** Which of the following is an example of a qualitative pollutant?
- CO₂
 - Dust
 - Pesticides
 - Water vapor

Ans :

Qualitative pollutants are man-made, like pesticides, while quantitative pollutants like CO₂ are naturally occurring substances in excess.

Thus (c) is the correct option.

- 27.** Biodegradable pollutants include:
- Plastic and glass
 - Vegetable peels and sewage
 - Pesticides and glass
 - Plastic and sewage

Ans :

Biodegradable pollutants are those that can decompose naturally, like vegetable peels and sewage, unlike non-biodegradable pollutants like plastic.

Thus (b) is the correct option.

- 28.** What term is used for agents causing pollution?
- Pollutants
 - Contaminants
 - Toxins
 - Carcinogens

Ans :

Pollutants are substances or agents that cause pollution, altering the environment's physical, chemical, or biological state undesirably.

Thus (a) is the correct option.

- 29.** Rahul is studying waste management and learns that non-biodegradable materials stay in the environment, causing pollution over time. An example of non-biodegradable waste is :
- Vegetable peels
 - Sewage
 - Livestock waste
 - DDT

Ans :

COMP 2015

DDT is non-biodegradable and persists in the environment, leading to long-term pollution and bioaccumulation.

Thus (d) is correct option.

- 30.** Amit is studying the ozone hole and learns it has harmful effects due to increased UV exposure on Earth. Ozone hole results in
- UV radiation reaching the earth
 - Increase in skin cancer
 - Cataract
 - All the above

Ans :

SQP 2011

- (c) A – Carbon monoxide, B – Lead.
 (d) A – Ozone, B – Plastic waste.

Ans :

MAIN 2010

Particulate matter causes smog and respiratory issues. Heavy metals bioaccumulate, affecting the food chain.

Thus (a) is the correct option.

43. Rahul matched pollutants with their effects on the environment. He tabulated the pairs as follows:

Pollutant	Effect on the environment
A	Causes acid rain, damaging plants and soil.
B	Reduces the oxygen level in water bodies

Identify the correct pair of pollutants:

- (a) A – Sulfur dioxide, B – Oil spills.
 (b) A – Nitrogen oxides, B – Organic waste.
 (c) A – Carbon monoxide, B – Nitrates.
 (d) A – Methane, B – Heavy metals.

Ans :

COMP 2015

Nitrogen oxides cause acid rain, while organic waste depletes oxygen in water, harming aquatic life.

Thus (c) is the correct option.

44. Anjali matched pollutants with their effects on the environment. She tabulated the pairs as follows:

Pollutant	Effect on the environment
A	Causes thinning of the ozone layer.
B	Affects Plants growth by reducing

Identify the correct pair of pollutants:

- (a) A – CFCs, B – Excessive fertilizers.
 (b) A – Methane, B – Plastic waste.
 (c) A – Carbon dioxide, B – Heavy metals.
 (d) A – Sulfur dioxide, B – Pesticides.

Ans :

SQP 2015

CFCs deplete the ozone layer. Excessive fertilizers reduce soil fertility, harming plant growth.

Thus (a) is the correct option.

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ONE MARK QUESTIONS

DIRECTION : Name the following :

45. The undesirable change in the environment leading to its deterioration.

Ans :

SQP 2025

Pollution

46. Mention two harmful effects of noise pollution.

Ans :

MAIN 2024

Damage ear drum / Nervous irritability / Disturbs sleep

47. A non-biodegradable pesticide.

Ans :

MAIN 2013

Dichloro Diphenyl Trichloroethane.

48. The pollutants that cannot be broken down to simple and harmless products.

Ans :

COMP 2016

Non-biodegradable

49. The chemicals leading to the formation of ozone hole.

Ans :

SQP 2012

Chlorofluorocarbons

50. The gases which mainly contribute for causing acid rains.

Ans :

COMP 2014

Sulphur dioxide and nitrogen oxides

51. The element which cause radiations.

Ans :

MAIN 2010

Uranium/thorium/strontium

52. The gas that reduces O₂ carrying capacity of the blood.

Ans :

COMP 2011

Carbon monoxide

53. Increase in concentration of certain non-biodegradable substances in higher trophic levels of a food chain.

Ans :

SQP 2018

Biomagnification

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37. A geography teacher asked her students to provide two causes of soil pollution.

Rahul said : Excessive use of fertilizers and Plastic waste.

Shweta said : Overgrazing and Rainwater harvesting.

Manish said : Industrial waste and Pesticides.

Ananya said : Afforestation and Mining.

Who were correct?

- (a) Rahul and Manish
(b) Shweta and Ananya
(c) Rahul and Shweta
(d) Manish and Ananya

Ans :

COMP 2019

Excessive use of fertilizers, plastic waste, industrial waste, and pesticides all contribute to soil pollution. Afforestation and rainwater harvesting are beneficial practices.

Thus (a) is correct option.

38. A science teacher asked her students to give two examples of greenhouse gases.

Rohit said : Carbon dioxide and Methane.

Sara said : Nitrogen and Oxygen.

Vikas said : Water vapor and Methane.

Nina said : Carbon monoxide and Ozone.

Who were correct ?

- (a) Rohit and Sara (b) Rohit and Vikas
(c) Vikas and Nina (d) Sara and Nina

Ans :

MAIN 2017

Carbon dioxide, methane, and water vapor are greenhouse gases. Nitrogen, oxygen, and carbon monoxide are not greenhouse gases.

Thus (b) is correct option.

39. A physics teacher asked the students to give two examples of non-conventional energy sources.

Kartik said : Solar energy and Wind energy.

Arjun said : Coal and Biomass energy.

Nisha said : Wind energy and Geothermal energy.

Meera said : Natural gas and Solar energy.

Who were correct?

- (a) Kartik and Meera
(b) Arjun and Nisha
(c) Kartik and Nisha
(d) Arjun and Meera

Ans :

SQP 2018

Solar, wind, and geothermal energy are non-conventional sources of energy. Coal and natural gas are conventional sources.

Thus (c) is correct option.

DIRECTION : Matching Type Question

40. Sita matched pollutants with their effects on the environment. She tabulated the pairs as follows:

Pollutant	Effect on the environment
A	Causes global warming and ice cap melting.
B	Pollutes water, leading to algal blooms.

Identify the correct pair of pollutants:

- (a) A – Methane, B – Nitrates.
(b) A – Carbon monoxide, B – Pesticides.
(c) A – Ozone, B – Heavy metals.
(d) A – Carbon dioxide, B – Phosphates.

Ans :

MAIN 2012

Carbon dioxide contributes to global warming. Phosphates in fertilizers cause algal blooms, depleting oxygen in water bodies.

Thus (d) is the correct option.

41. Neha matched pollutants with their effects on the environment. She tabulated the pairs as follows:

Pollutant	Effect on the environment
A	Leads to hearing loss and stress in humans.
B	Pollutes water and harms marine life.

Identify the correct pair of pollutants:

- (a) A – Noise pollution, B – Oil spills.
(b) A – Particulate matter, B – Phosphates.
(c) A – Lead, B – Nitrates.
(d) A – Nitrogen oxides, B – Carbon dioxide.

Ans :

COMP 2011

Noise pollution causes hearing loss. Oil spills pollute water, affecting marine organisms.

Thus (d) is the correct option.

42. Ravi matched pollutants with their effects on the environment. He tabulated the pairs as follows:

Pollutant	Effect on the environment
A	Causes smog and respiratory issues in humans.
B	Leads to bioaccumulation in aquatic organisms.

Identify the correct pair of pollutants:

- (a) A – Particulate matter, B – Heavy metals.
(b) A – Nitrogen dioxide, B – Pesticides.

DIRECTION : Give the Biological/technical term for the following :

- 76.** The process causing an undesirable change in the environment.

Ans : MAIN 2016
Pollution

- 77.** A constituent that causes pollution. 2013

Ans : COMP 2019
Pollutants

DIRECTION : The statement given below is false. Rewrite the correct form of the statement by changing the word which is underlined.

- 78.** CNG is mainly responsible for the formation of acid rain.

Ans : SQP 2015
SO₂ is mainly responsible for the formation of acid rain.

DIRECTION : Choose the ODD one out from the following terms given and name the CATEGORY to which the others belong :

- 79.** Example : Nose, Tongue, Arm, Eye

Ans : COMP 2018
Odd Term - Arm, Category - Sense organs).

- 80.** Detergents, X-rays, sewage, oil spills.

Ans : MAIN 2018
Odd term - X rays.

- 81.** Sewage, Newspaper, Styrofoam, Hay.

Ans : COMP 2016
Styrofoam, All others are biodegradable pollutants.

DIRECTION : Fill in the blanks with suitable words in the following sentences :

- 82.** Automobiles are the largest source of _____ pollution in cities.

Ans : SQP 2019
Air

- 83.** Substances which degrades the quality/ productivity of soil are regarded as _____

Ans : COMP 2020
Soil pollutants

- 84.** DDT is a _____ type of pollutant and undergoes _____ in successive trophic levels.

Ans : MAIN 2010
Non-biodegradable, Bio-magnification

- 85.** _____ are the major aerosol pollutant present in jet emission, cause ozone depletion.

Ans : SQP 2015
Chlorofluorocarbons

- 86.** BOD stands for _____ and it indicates the degree of _____.

Ans : MAIN 2017
Biological oxygen demand, water pollution

- 87.** A heavy metal pollutant released in automobile exhausts _____.

Ans : COMP 2019
Lead

- 88.** Afforestation can check the advancement of _____.

Ans : SQP 2017
Desert

- 89.** The coal using electric power plants cause _____ pollution as well as _____ pollution.

Ans : MAIN 2019
Air, thermal/water

- 90.** An undesirable change in the environment is called _____.

Ans : COMP 2020
Pollution

- 91.** The pollutants that can be decomposed by microorganisms is _____.

Ans : MAIN 2009
Biodegradable

- 92.** _____ Cause depletion of ozone layer.

Ans : SQP 2010

- 54.** The primary source of air pollution in metropolitan cities.

Ans : MAIN 2019
Automobile pollution

- 55.** The main disease caused by air pollution.

Ans : COMP 2020
Respiratory diseases such as bronchitis, asthma and lung diseases are mainly caused by air pollution.

- 56.** Two natural sources of pollution.

Ans : SQP 2023
Forest fires, volcanic eruptions, cyclones and floods.

- 57.** A disease caused by air pollution.

Ans : COMP 2000
Tuberculosis

- 58.** A green house gas.

Ans : MAIN 2005
 CO_2

- 59.** A poisonous allotropic form of oxygen.

Ans : COMP 2009
Ozone

- 60.** The main source of water pollution.

Ans : MAIN 2010
Sewage

- 61.** A disease caused by prolonged exposure to radiation.

Ans : COMP 2015
Cancer

- 62.** The vehicular standard for controlling air pollution.

Ans : SQP 2019
Euro III.

- 63.** Two sources of water pollution.

Ans : MAIN 2020
Sewage, fertilizers

- 64.** The cause of eutrophication in lake.

Ans : COMP 2023

Fertilizers

- 65.** The biggest source of air pollution in big cities.

Ans : SQP 2000
Vehicles/automobiles

- 66.** The source of acid rain.

Ans : MAIN 2005
 SO_2

- 67.** A greenhouse gas.

Ans : COMP 2001
 CO_2

- 68.** The major source of marine water pollution.

Ans : SQP 2009
Oil spills

- 69.** A disease caused due to water pollution.

Ans : COMP 2010
Typhoid/Jaundice

- 70.** An example of biodegradable pollutant.

Ans : SQP 2015
Vegetable peel

- 71.** An example of non-biodegradable pollutant.

Ans : MAIN 2010
DDT/plastic

- 72.** The substance that cause pollution.

Ans : COMP 2013
Pollutants

- 73.** An increase in the toxic materials at each level of food chain.

Ans : SQP 2016
Biomagnification

- 74.** The chemical that causes depletion of ozone layer.

Ans : MAIN 2017
CFC

- 75.** A disease caused by prolonged exposure to radiation.

Ans : MAIN 2005
Cancer

DIRECTION : Complete the following:

112. _____ is an example of particulate pollutant.

Ans : MANI 2021

Dust

113. _____ are the chief cause of depletion of ozone layer.

Ans : COMP 2023

CFCs

114. Hot water is given out from _____ power plant.

Ans : SQP 2021

Thermal

115. A decibel value more than _____ decibel causes noise pollution.

Ans : MAIN 2000

80

116. Noise pollution is measured in _____.

Ans : SQP 2001

Decibels

117. The type of pollution which affects respiratory tract is _____.

Ans : COMP 2005

Air pollution

118. The pollutants which can be decomposed by micro-organisms is _____.

Ans : MAIN 2007

Biodegradable

119. _____ is an air pollutant which affects visibility.

Ans : COMP 2011

Smog

120. Inhalation of _____ lowers the O₂ carrying capacity of haemoglobin.

Ans : MAIN 2013

CO

121. _____ is a threat to life both on land and in water.

Ans : SQP 2019

Pesticides/DDT

122. _____ is the major pollutant of acid rain.

Ans : COMP 2000

SO₂

123. _____ a combination of fog and smoke.

Ans : MAIN 2001

Smog

124. Ozone intercept _____ radiation.

Ans : SQP 2005

UV

125. Ozone is found at _____ of the atmosphere.

Ans : MAIN 2007

Stratosphere

126. Excessive nourishment leading to the loss of aquatic life is _____.

Ans : COMP 2010

Eutrophication

127. Greenhouse effect leads to _____.

Ans : MAIN 2015

Global warming

DIRECTION : Mention one difference between:

128. Primary and Secondary pollutants.

Ans : COMP 2016

Primary pollutants remain in the environment, in the form to which they are released. Secondary pollutants are formed by the reaction between two primary pollutant or with the environmental factors.

129. Biodegradable and non-biodegradable pollutants.

Ans : SQP 2018

Biodegradable pollutants are organic in nature and decompose by bacteria and fungi. Non-biodegradable pollutants are inorganic and not decompose by biological agents.

DIRECTION : Define the following :

130. Biomedical wastes.

Ans : MAIN 2019

CFCs

93. A combination of smoke and fog is _____.

Ans : COMP 2015

Smog

94. Noise is measured in _____.

Ans : MAIN 2017

Decibel

DIRECTION : Write “True” or “False”.

95. Man is the only source of environment pollution.

Ans : COMP 2019

False

96. All pollutants are degradable.

Ans : MAIN 2018

False

97. All types of wastelands can be reclaimed.

Ans : SQP 2011

True

98. All types of pollutants can be recycled.

Ans : MAIN 2015

False

99. Kolkata is the most polluted city in India.

Ans : COMP 2019

True

100. Underground water is safest and not polluted.

Ans : SQP 2011

False

101. DDT is a non-degradable pollutant.

Ans : COMP 2015

True

102. Any unwanted sound is called noise.

Ans : MAIN 2017

True.

103. Insecticides are the main source of air pollution.

Ans : COMP 2019

False. Automobiles fuel are the main source of air pollution.

104. 16th September is the International ozone day.

Ans : SQP 2011

True.

105. CO₂ reduces the O₂ carrying capacity of hemoglobin.

Ans : MAIN 2015

True.

106. Eutrophication in lakes is due to pesticides.

Ans : COMP 2019

False. Eutrophication in lakes is due to fertilizers.

DIRECTION : Choose the correct option from the brackets:

107. International ozone day is on
[11th July, 16th September, 5th June, 16th August]

Ans : SQP 2018

16th September.

108. Which among the following diseases is caused by water pollution?

[Measles, tuberculosis, typhoid, haemophilia]

Ans : MAIN 2015

Typhoid.

109. The prime source of chlorofluorocarbons is:

[Vehicular emissions, Industrial effluents, Domestic sewage, Refrigeration equipments]

Ans : COMP 2019

Refrigeration equipments

110. Which among the following is the main cause of ozone depletion?

[Sulphur dioxide, carbon dioxide, CFCs, nitrogen dioxide]

Ans : COMP 2019

CFCs.

111. An increased rate of greenhouse gases causes

[Depletion of ozone layer, global warming, eutrophication, algal bloom]

Ans : MANI 2020

Global warming.

The ozone hole allows more UV radiation to reach Earth, leading to skin cancer, cataracts, and other environmental impacts.

Thus (d) is correct option.

- 31.** In the textbook, you came across Three Mile Island and Chernobyl disasters associated with accidental leakage of radioactive wastes. In India, we had Bhopal gas tragedy. It is associated with which of the following?

(a) CO_2
 (b) CFCs
 (c) Methyl isocyanate
 (d) Methyl cyanate

Ans :

MAIN 2016

The Bhopal gas tragedy was caused by the accidental release of methyl isocyanate gas, resulting in widespread illness and fatalities.

Thus (c) is correct option.

- 32.** Meena is studying greenhouse gases and learns that certain gases trap heat in the Earth's atmosphere, contributing to the greenhouse effect and global warming. Which among the following is the main cause of ozone depletion?

(a) Sulphur dioxide
 (b) Carbon dioxide
 (c) Nitrogen dioxide
 (d) CFCs

Ans :

MAIN 2001

CO_2 is a greenhouse gas that traps heat in the atmosphere, playing a significant role in the greenhouse effect and contributing to global warming.

Thus (d) is correct option.

- 33.** Pooja is studying types of pollutants and finds that radiation pollutants, unlike others, emit harmful radiation into the environment, posing serious health risks. One of the examples of radiation pollutants is

(a) Sulphur dioxide
 (b) Iodine - 131
 (c) Ozone
 (d) Discarded fused electric bulbs

Ans :

MAIN 2019

Iodine-131 is a radioactive pollutant that emits radiation, leading to potential health hazards, especially when it accumulates in the human thyroid.

Thus (b) is correct option.

- 34.** Sunil is learning about alternative fuels and comes across Compressed Natural Gas (CNG), which is widely used as a cleaner fuel for vehicles. He wants to know its primary component. Compressed Natural Gas (CNG) is

(a) Propane
 (d) Butane
 (c) Ethane
 (d) Methane

Ans :

SQP 2008

CNG primarily consists of methane, a cleaner-burning fuel that reduces harmful emissions compared to conventional gasoline or diesel.

Thus (d) is correct option.

DIRECTION : Conversation Based Question

- 35.** A teacher asked her students to name two non-biodegradable pollutants.

Maya said : Plastic and Glass.

Ajay said : Paper and Vegetable peels.

Tina said : DDT and Plastic.

Rohan said : Sewage and Wood.

Who were correct?

(a) Maya and Ajay
 (b) Ajay and Rohan
 (c) Maya and Tina
 (d) Tina and Rohan

Ans :

COMP 2019

Plastic, glass, and DDT are non-biodegradable. Paper, vegetable peels, sewage, and wood are biodegradable. Thus (c) is correct option.

- 36.** The biology teacher asked her students to name two examples of renewable energy sources.

Kiran said : Wind energy and Solar energy.

Anu said : Coal and Natural gas.

Pooja said : Solar energy and Hydroelectric power.

Ravi said : Petroleum and Wind energy.

Who were correct?

(a) Kiran and Anu
 (b) Anu and Ravi
 (c) Kiran and Pooja
 (d) Pooja and Ravi

Ans :

MAIN 2013

Wind, solar, and hydroelectric power are renewable energy sources. Coal, natural gas, and petroleum are non-renewable energy sources. Thus (a) is correct option.

Biomedical wastes are generated from the hospitals clinics and nursing homes. These when disposed in the soil, deteriorate the soil quality. It may kill the soil organisms. These include needle, syringe, unused tablets, dressings etc.

131. Acid rain

Ans : COMP 2020

Burning of fossil fuels like coal produces SO_2 . It combines with water in the atmosphere and forms sulphuric acid that falls as acid rain. It pollutes rivers and damages buildings and monuments.

132. Thermal pollution

Ans : SQP 2022

The hot water released from the thermal power plant into water bodies causes thermal pollution. It affects the life of aquatic organisms.

133. Eutrophication

Ans : MAIN 2020

Excessive nourishment due to discharge of sewage into static water leads to the loss of aquatic life. The organic matter increases growth of algae that consumes a lot of O_2 content for respiration. This decreases the O_2 level and causes problem for aquatic organisms.

134. Biomagnification

Ans : COMP 2000

High concentration of toxic substances like DDT in the various levels of food chains.

135. Non-biodegradable pollutants.

Ans : SQP 2001

The pollutants that are not decomposed by micro-organisms e.g. DDT, plastic, etc.

136. Global warming.

Ans : MAIN 2005

Increasing concentration of CO_2 in the atmosphere due to burning of fossil fuels causes heating of the earth's surface that may cause melting of glaciers.

137. Greenhouse effect.

Ans : COMP 2010

Burning of fossil fuels produces CO_2 that is used by plants for photosynthesis. Excessive accumulation of CO_2 near the earth's surface traps the heat and prevents the escape of heat. This results in the

warming up of the earth.

138. Noise pollution

Ans : SQP 2015

Unwanted sound that may cause harm to the living organisms is noise pollution.

139. Ozone hole

Ans : MAIN 2019

Release of some chemicals like CFCs from refrigerators as chlorine radicals break ozone to release oxygen and thus make the layer of ozone thinner. This is called ozone hole.

DIRECTION : Answer the following :

140. Give examples of two gaseous pollutants.

Ans : SQP 2012

CO_2 , SO_2

141. What are the sources of water pollution ?

Ans : COMP 2013

Sewage, agricultural wastes.

142. What is the effect of inhalation of CO ?

Ans : MAIN 2015

It reduces the O_2 carrying capacity of haemoglobin.

143. What are the sources of radiation ?

Ans : COMP 2019

X-rays, nuclear explosives.

144. Name the unit to measure noise pollution.

Ans : MAIN 2020

Decibels (dB).

145. Define oil spill.

Ans : COMP 2005

It is the leakage of oil on the surface of sea water during transport and unloading of oil tanker.

146. In which zone of atmosphere, ozone layer is present?

Ans : SQP 2007

Stratosphere.

147. What are Qualitative pollutants ?

Ans : MAIN 2006

These are not natural but added to the environment by the activity of man.

148. Define contamination.

Ans : COMP 2010

Contamination is the presence of harmful organisms or their products causing disease or discomfort.

149. Define quantitative pollutants.

Ans : SQP 2015

Ingredients whose concentration reach beyond a threshold value in the environment become pollutants, e.g., CO, CO₂, nitrogen oxides.

150. What constitutes smog ?

Ans : SQP 2015

Smog is dark or opaque fog which is formed by the dust and smoke articles causing condensation of water vapours around them as well as attracting chemicals like SO₂, H₂S, NO₂ etc.

151. What would happen if CO₂ concentration of the atmosphere increases ?

Ans : MAIN 2016

It leads to greenhouse effect.

152. What are the sources of noise pollution ?

Ans : COMP 2018

Loud speakers, jet planes, musical bands in public places, etc.

TWO MARKS QUESTIONS

153. State two objectives of Swachh Bharat Abhiyan.

Ans : SQP 2025

To clean streets, roads, cities and towns To eliminate open defecation by constructing toilets. Management of solid and liquid waste.

154. Carbon monoxide is dangerous when inhaled in excess. Comment on the statement.

Ans : MAIN 2024

Carbon monoxide easily combines with haemoglobin to form Carboxyhemoglobin, which cuts off supply of oxygen to tissues.

155. State two harmful effects of acid rain on the environment.

Ans : MAIN 2024

Harmful effects of acid rain :

- (i) It corrodes buildings and metal structures.
- (ii) It can also affect human health by causing respiratory diseases like asthma.
- (iii) It leads to the acidification of lakes and rivers, which harms aquatic life.

156. State any two harmful effects of acid rain.

Ans : SQP 2013

Damage to vegetation/decay of building materials and paints/erosion of ancient monuments, statues and sculptures/degrades visibility and harms human health/marine life harmed due to increased acidity of water.

157. Explain the term greenhouse effect

Ans : COMP 2015

A naturally occurring process that aids in heating the Earth's surface and atmosphere. Certain atmospheric gases like CO₂, water vapour and methane are able to change the energy balance of the planet by absorbing long wave radiation emitted from Earth's surface. Without greenhouse effect life on this planet would probably not exist.

158. Match the items given in column A and B.

	Column A		Column B
(a)	Earmuffs	(i)	Particulate matter
(b)	Aerosol	(ii)	High noise level
(c)	Landfills	(iii)	Chlorofluorocarbon
(d)	Electrostatic precipitators	(iv)	CO and NO
(e)	Catalytic converter	(v)	Solid wastes

Ans : SQP 2017

(a)-(ii), (b)-(iii), (c)-(v), (d)-(i), (e)-(iv)

159. Define BOD. What is its use ?

Ans : MAIN 2019

Biological oxygen demand is the amount of oxygen required by phytoplanktons of polluted water to complete the decomposition of organic matter present in one litre of water. The value of BOD indicates the degree of water pollution. Higher its value, the more is the degree of water polluted.

160. Write two effects of soil pollution.

Ans :

COMP 2020

Two effects of soil pollution are as follows :

- (i) Excessive use of fertilizers and pesticides kills bacteria present in the soil and reduces soil fertility.
- (ii) Acid rain decreases the fertility of soil.

161. Define thermal pollution. What are its effects ?

Ans :

SQP 2023

It is caused by the discharge of hot water into the lakes and streams by the industries which use water for cooling purposes. It affects the biotic life in water. The desirable forms are replaced by non-desirable forms such as pathogenic forms. Hot water also affects. The reproductive capability of the organisms.

162. What are the effects of noise pollution ?

Ans :

MAIN 2021

- (i) Prolonged exposure to noise above 80dB can damage eardrum.
- (ii) Noise disturbs sleep that lead to nervous disorders.
- (iii) It also disturbs the birds.

163. Write two methods to control noise pollution.

Ans :

COMP 2020

- (i) Planting trees interrupt the path of transmission.
- (ii) Prohibiting blowing of horns near hospitals and schools.
- (iii) Using ear plugs.

164. State any two harmful effects of acid rain.

Ans :

MAIN 2011

Acid rain is harmful to eco systems, human health, heritage buildings, marble statues etc.

165. What is the purpose of using unleaded petrol?

Ans :

COMP 2015

When petrol contains lead it produces harmful gases that may cause health problems. Unleaded petrol reduces the ill effects to a certain level.

166. Suggest any two methods of controlling automobile pollution.

Ans :

SQP 2012

- (i) Fitting anti-pollution devices.
- (ii) Efficient engines should be fitted in vehicles.
- (iii) Use of CNG in vehicles.
- (iv) Use lead-free petrol.

167. List two measures each for controlling air pollution and water pollution.

Ans :

MAIN 2013

Air pollution –

- (i) Pollutants from industries can be controlled by scrubbers and filters.
- (ii) Non-polluting gases can be used in vehicles like CNG.

Water pollution –

- (i) Treatment of sewage is done before discharging them into water bodies.
- (ii) Excessive use of fertilizers and pesticides should be avoided.

168. Why the use of CFCs should be banned?

Ans :

COMP 2019

CFCs rise into the atmosphere and reduction of ozone into O_2 takes place, thereby causing depletion of the ozone layer due to rapid production of O_3 . Ozone holes cannot prevent UV rays from entering the troposphere as a result, UV rays cause diseases like skin cancer and cataract.

169. What is Montreal Protocol?

Ans :

MAIN 2015

It is an international agreement to protect ozone layer by reducing the production of ozone depleting substances. This agreement has been signed by more than 175 countries.

170. When did Chernobyl disaster occur? How did it happen?

Ans :

SQP 2017

Chernobyl disaster took place due to the explosion of four reactors of a nuclear power plant on 26th April, 1986 at Chernobyl, in Ukraine, USSR. This was mainly due to leaking of nuclear radiation that caused several deaths.

171. What is ozone hole? How are they produced? How it affects the life on the earth?

Ans :

SQP 2012

Ozone is an allotropic form of oxygen. It is located at the upper atmosphere (stratosphere). This protects the earth from harmful UV radiations. In the stratosphere, the UV radiations transforms

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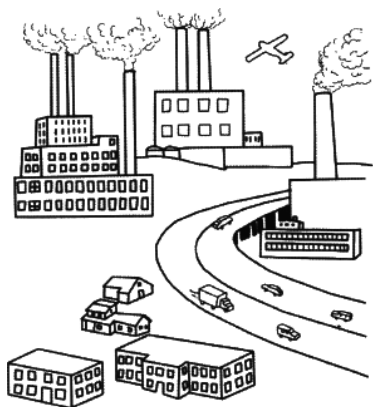
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Swachh Bharat is evaluated on regular basis. People from different sections of the society have come forward and join this mass movement of cleanliness. The municipal corporation needs to improve the system of garbage disposal for better and hygienic cities towns in India.

178. The given figure shows air pollution. Study the figure and answer the following questions.



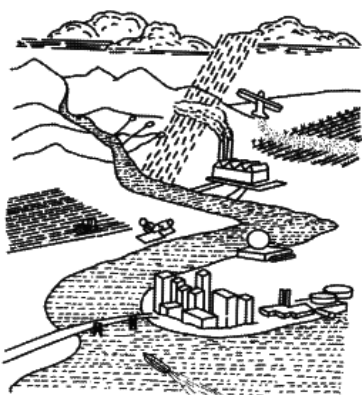
- (i) Write the sources of air pollution.
- (ii) What are the effects of it? Give three points.
- (iii) How would you control it?

Ans :

MAIN 2015

- (i) Vehicles and Industries.
- (ii) (a) It damages the respiratory tract of human.
(b) Hydro-carbons cause cancer.
(c) It also reduces crop yield.
- (iii) (a) Particulate pollutants should be controlled by scrubbers.
(b) Remove sulphur from fuel before use.

179. Riya notices that waste from factories and homes flows untreated into the nearby river, leading to pollution. This has affected aquatic life and the local community relying on the river.



- (i) What is water pollution?
- (ii) Write two effects of it.
- (iii) What are the sources of it?

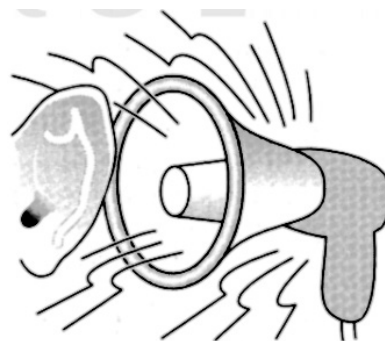
Ans :

COMP 2019

- (i) Addition of harmful pollutants into water bodies that may adversely affect the aquatic life is water pollution.
- (ii) (a) It causes many diseases.
(b) Oil spills cause reduction in O_2 supply to aquatic organisms.
- (iii) (a) Domestic wastes
(b) Industrial wastes
(c) Agricultural wastes

FIVE MARKS QUESTIONS

180. Given below is a representation of a kind of pollution. Study the same and answer the questions that follow :



- (i) Name the kind of pollution.
- (ii) List any three common sources of this pollution.
- (iii) Mention three harmful effects of this pollution on human health.
- (iv) Explain the term 'Pollutant'.
- (v) Name two soil pollutants.

Ans :

COMP 2017

- (i) Noise pollution.
- (ii) Automobiles and road transport, jet aeroplanes, loudspeakers, radio and musical bands.
- (iii) Nervous irritability, damage of eardrum, disturbs piece of mind.
- (iv) The agents that cause pollution is called Pollutant.
- (v) Pesticides, Styrofoam, Chemical fertilizers, domestic and industrial wastes.

181. Given below is a representation of a type of pollution.



Study the picture and answer the questions :

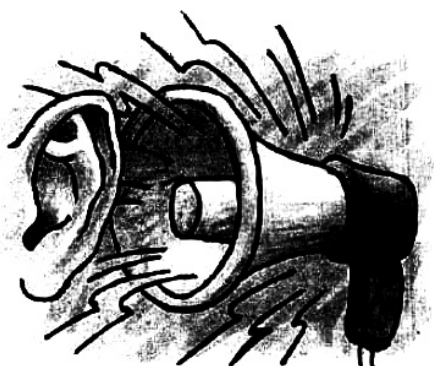
- Name the type of pollution shown in the picture.
- Name one source of this pollution.
- How does this pollution affect human health?
- Write one measure to reduce this pollution.
- State one gaseous compound that leads to the depletion of the ozone layer and creates 'Ozone holes'.

Ans :

SQP 2018

- Air pollution.
- Smoke from vehicles/harmful gases from industries.
- SO_2 causes bronchitis, Lead causes blood cell shortage, Smog leads to asthma and poor visibility, Oxides of nitrogen decreases oxygen carrying capacity of blood.
- Use of lead free petrol and CNG.
- Chloroflourocarbon.

182. Given below is a representation of a kind of pollution. Study the same and answer the questions that follow:



- Name the kind of pollution.
- List any three common sources of this pollution.
- Mention three harmful effects of this pollution on human health.
- Explain the term 'Pollutant'.
- Name two soil pollutants.

Ans :

MAIN 2021

- Noise pollution.
- The sources of noise pollution are loud speakers, horns of automobiles, jet engines etc.
- Prolonged exposure to noise above 80 db can damage eardrum.
 - Disturbs sleep thereby leads to nervous disorders.
 - It interferes communication.
- Pollutants are the unwanted substances introduced into the environment which adversely affect the environment.
- Soil pollutants are fertilisers, pesticides, lead biomedical wastes etc.

CASE BASED QUESTION

183. Air pollution results from vehicle exhaust and industrial emissions, causing respiratory problems like asthma and bronchitis. It also contributes to environmental issues like acid rain and global warming.

- What are the main causes of air pollution?
- How does air pollution affect human health?
- What environmental issues are caused by air pollution?
- How can air pollution be controlled?

Ans :

- Vehicle exhaust and industrial emissions.
- It causes respiratory issues like asthma.
- Acid rain and global warming.
- By using filters and planting trees.

184. Water pollution occurs when pollutants like sewage, industrial waste, and chemicals enter water bodies. It harms aquatic life and makes water unsafe for drinking and other uses.

- What are the sources of water pollution?
- How does water pollution affect aquatic life?
- What diseases are caused by polluted water?
- How can water pollution be reduced?

Ans :

- (i) Sewage, industrial waste, and chemicals.
- (ii) It depletes oxygen, killing aquatic organisms.
- (iii) Cholera and typhoid.
- (iv) By recycling waste and treating sewage.

- 185.** Ravi lives close to a busy road and near a factory area. He constantly hears loud noises from vehicles, machines, and construction work, which affects his sleep and concentration. Recently, Ravi has noticed that his neighbors are also facing similar issues due to the continuous noise in the area.



- (i) Name the kind of pollution.
- (ii) List any three common sources of this pollution.
- (iii) Mention three harmful effects of this pollution on human health.
- (iv) Explain the term 'Pollutant'.
- (v) Name two soil pollutants.

Ans :

- (i) Noise pollution.
- (ii) The sources of noise pollution are loudspeakers, vehicle horns, and construction activities.
- (iii) Prolonged exposure to loud noise can damage the eardrum. Disturbs sleep and leads to nervous disorders. Interferes with communication.
- (iv) Pollutants are unwanted substances introduced into the environment that adversely affect it.
- (v) Soil pollutants include fertilizers, pesticides, and lead.

O_2 to O_3 . The oxygen molecule is broken down by solar radiation into free oxygen atoms. These then react with oxygen molecules to form ozone. Ozone hole is the thinning of ozone layer by some air pollutants like CFC, that react with oxygen to form CO_2 and generate heat in the atmosphere resulting in global warming. Depletion of ozone layer causes skin cancer, cataract etc.

172. Study the given figure and answer the following questions :



- (i) What does the figure depict ?
(ii) Write three sources of the figure.

Ans :

COMP 2021

- (i) Noise pollution
(ii) (a) Loud speaker
(b) Radio
(c) Horns of automobiles.

173. What is sewage? What is the effect of discharging untreated sewage into the river?

Ans :

SQP 2014

Sewage is the liquid wastes from the household activities, such as kitchen wastes. Untreated sewage disposed into the river may reduce the amount of oxygen content in the river due to algal bloom.

174. How does sewage treatment plants reduces pollution?

Ans :

MAIN 2015

Sewage treatment removes the harmful substances and the treated water can be used for various purposes like in agriculture as it contains many minerals like potassium, nitrogen, phosphorus, etc. in it.

175. Soil pollution occurs due to chemical fertilizers, pesticides, and industrial waste. It reduces soil fertility and contaminates groundwater, affecting agriculture and human health.

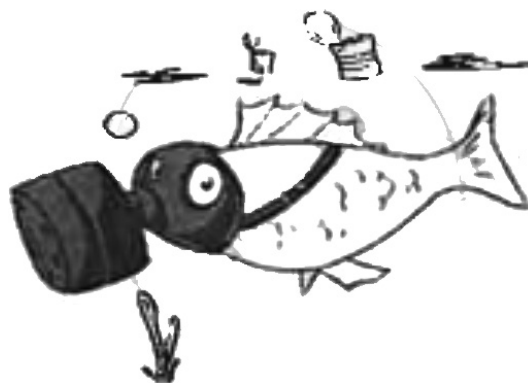
- (i) What causes soil pollution?
(ii) How does soil pollution affect agriculture?

Ans :

- (i) Chemical fertilizers, pesticides, and industrial waste.
(ii) It reduces soil fertility.

THREE MARKS QUESTIONS

176. Study the picture given below and answer the questions:



- (i) How does water get polluted?
(ii) What is the effect of water pollution on human life?
(iii) Mention one control measure to stop the pollution of water bodies.

Ans :

SQP 2025

- (i) Sewage, industrial effluents, oil spills
(ii) Spread of diseases like diarrhea, cholera, typhoid.
(iii) Sewage must be treated before letting it into water bodies.

177. Write briefly about Swach Bharat Abhiyan.

Ans :

MAIN 2019

Swach Bharat Abhiyan (A national campaign for clean India) is a campaign initiated by government of India that aims to clean up the streets, roads and infrastructure of India's cities, small towns and rural areas. It also aims to eliminate open defecation the performance of each city towards